Year 1 Monitoring Report for

Site 23 Underdrain Metering Pit Sampling

Naval Submarine Base New London Groton, Connecticut



Naval Facilities Engineering Command Mid-Atlantic

Contract Number N62472-03-D-0057 Contract Task Order 73

September 2008

YEAR 1 MONITORING REPORT FOR SITE 23 - UNDERDRAIN METERING PIT

NAVAL SUBMARINE BASE NEW LONDON GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Submitted by: Tetra Tech NUS, Inc. 260 Mall Boulevard, Suite 260 King of Prussia, PA 19406

CONTRACT NUMBER N62472-03-D-0057 CONTRACT TASK ORDER 73

SEPTEMBER 2008

PREPARED UNDER THE DIRECTION OF:

APPROVED FOR SUBMISSION BY:

COREY A. RICH, P.E. PROJECT MANAGER TETRA TECH NUS, INC.

PITTSBURGH, PENNSYLVANIA

JOHN J. TREPANOWSKÍ, P.E.

PROGRAM MANAGER TETRA TECH NUS, INC.

KING OF PRUSSIA, PENNSYLVANIA

TABLE OF CONTENTS

<u>SECTION</u>					
ACR	ONYMS		v		
1.0	INTRO	DUCTION	1-1		
	1.1	PURPOSE			
	1.2	OBJECTIVES			
	1.3	FACILITY LOCATION AND DESCRIPTION			
	1.4	SITE LOCATION AND DESCRIPTION			
	1.5	REPORT FORMAT			
2.0	FIELD '	WORK	2-1		
	2.1	SAMPLE COLLECTION	2-1		
	2.2	WATER QUALITY	2-2		
	2.3	ANALYTICAL PROGRAM			
	2.4	QA/QC PROGRAM	2-3		
	2.5	DECONTAMINATION			
3.0	RESUL	TS			
	3.1	DATA VALIDATION	3-1		
	3.1.1	Data Validation Process	3-1		
	3.1.2	Data Validation Outputs	3-2		
	3.1.3	Data Quality Review			
	3.1.4	Completeness			
	3.1.5	Sensitivity	3-4		
	3.1.6	Laboratory Accuracy			
	3.1.7	Laboratory Precision			
	3.1.8	Comparability			
	3.1.9	Representativeness			
	3.2	QUALITY ASSURANCE/QUALITY CONTROL PROGRAM			
	3.3	ANALYTICAL DATA EVALUATION			
	3.4	STATISTICAL/TREND ANALYSIS			
	3.5	MEMORANDUM REGARDING HUMAN HEALTH RISKS ASSOCIATED			
	0.0	WITH SITE 23 GROUNDWATER (MAY 19, 2008)	3-10		
	3.6	MEMORANDUM REGARDING VAPOR INTRUSION EVALUATION FOR	10		
	3.0	GROUNDWATER AT OPERABLE UNIT 9 (MAY 30, 2008)	3-11		
4.0	CONCL	LUSIONS AND RECOMMENDATIONS	4-1		
	4.1	CONCLUSIONS			
	4.2	RECOMMENDATIONS			
REFE	ERENCES		R-1		
APPE	ENDICES				
	Α	FIELD FORMS			
	В	ROUND 4 DATA VALIDATION LETTER			
	С	YEAR 1 ANALYTICAL DATABASE			
	D	HUMAN HEALTH RISK ASSESSMENT MEMORANDUM			
	E	VAPOR INTRUSION EVALUATION FOR GROUNDWATER MEMORANI	DUM		

TABLES

NUMBER

- 2-1 Summary of Water Quality Measurements3-1 Data Rejection and Reasons for Rejections
- 3-2 Data Qualification and Reasons for Qualifications
- 3-3 Summary of Detected Concentrations

FIGURES

NUMBER

- 1-1 Facility Location Map
- 1-2 Site Location Map
- 1-3 Site Map, Site 23 Tank Farm
- 1-4 Site Plan, Storm Sewer Rehabilitation As-Built
- 1-5 Metering Pit As-Built, Field Sketch FSK-003

ACRONYMS

%C Percent completeness

%R Percent recovery

AS/SVE Air sparging/soil vapor extraction

AST above-ground storage tank

BGOURI Basewide Groundwater Operable Unit Remedial Investigation Report

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CLEAN Comprehensive Long-Term Environmental Action Navy

CLP Contract Laboratory Program

CTDEP Connecticut Department of Environmental Protection

CTO Contract Task Order

DERP Defense Environmental Restoration Program

DQI Data quality indicator
DO Dissolved oxygen

ETPH Extractable total petroleum hydrocarbons

FWEC Foster Wheeler Environmental Corporation

HDPE High-density polyethylene

HHRA Human Health Risk Assessment IRP Installation Restoration Program

LCS Laboratory control sample

LCSD LCS duplicate

MDL Method detection limit µg/L Microgram per liter mg/L Milligram per liter

mS/cm MilliSiemen per centimeter

MS/MSD Matrix spike/matrix spike duplicate

Navy United States Department of the Navy

NEX Naval Exchange

NSB-NLON Naval Submarine Base-New London

NTU Nephelometric turbidity unit
ORP Oxidation-reduction potential

OU Operable Unit

PAH Polynuclear aromatic hydrocarbon
PCMP Perforated corrugated metal pipe

PQL Practical quantitative limit

PVC Polyvinyl chloride

SEPTEMBER 2008

QA/QC Quality assurance/quality control

RCRA Resource Conservation and Recovery Act

RPD Relative percent difference

RSR Remediation Standard Regulations

SARA Superfund Amendments and Reauthorization Act

SVOC Semivolatile organic compound

TAL Target Analyte List
TCL Target Compound List
Tetra Tech Tetra Tech NUS, Inc.

TPH Total petroleum hydrocarbons

TSS Total suspended solids

USEPA United States Environmental Protection Agency

UST Underground storage tank
VOC Volatile organic compound

1.0 INTRODUCTION

1.1 PURPOSE

This Year 1 Monitoring Report summarizes the field activities, analytical results, and data evaluations for underdrain metering pit sampling at Site 23 (Tank Farm) at Naval Submarine Base-New London (NSB-NLON) in Groton, Connecticut. This work was conducted by Tetra Tech NUS, Inc. (Tetra Tech) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62472-03-D-0057, Contract Task Order (CTO) 073. The work is part of the United States Department of the Navy's (Navy) Installation Restoration Program (IRP), a component of the Defense Environmental Restoration Program (DERP) established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).

1.2 OBJECTIVES

The objective of the field work was to collect four quarterly rounds of water samples from the metering pit located just before the groundwater underdrain system connects with the storm sewer system, which then carries the combined flow to the Thames River outfall. The objective of this report is to summarize the results of the four quarterly sampling events conducted between June 2007 and February 2008 and to determine if the quality of groundwater conveyed by the underdrain piping poses potential risks to human health or the environment.

1.3 FACILITY LOCATION AND DESCRIPTION

NSB-NLON is located in southern Connecticut in the Towns of Ledyard and Groton. NSB-NLON is situated on the eastern bank of the Thames River, approximately 6 miles north of Long Island Sound. It is bordered on the east by Connecticut Route 12, on the south by Crystal Lake Road, and on the west by the Thames River. The northern border is a low ridge that trends approximately east-southeastward from the Thames River to Baldwin Hill. A general facility location map is presented as Figure 1-1. The location of each IRP site within NSB-NLON is shown on Figure 1-2.

1.4 SITE LOCATION AND DESCRIPTION

Site 23 is located between Tang Avenue and Crystal Lake Road in the southern portion of NSB-NLON. The general configuration of Site 23 is shown on Figure 1-3.

The Tank Farm features nine former underground storage tanks (UST) that were demolished and closed in place, a 30,000-gallon, double-walled UST (OT-10), a former oil/water separator, a 10,000-gallon

waste oil tank, a fuel oil loading area, a tanker truck dumping pad and trough, associated UST piping systems, baseball/softball fields, buildings that housed the former air sparging/soil vapor extraction (AS/SVE) facility for the Naval Exchange (NEX) service station, two 150,000-gallon diesel above-ground storage tank (ASTs), and other buildings. The soil at Site 23 was investigated and remediated under the Connecticut Department of Environmental Protection (CTDEP) Resource Conservation and Recovery Act (RCRA) UST Program. Groundwater associated with the site is being investigated under CERCLA (TtNUS, 2006) and is considered part of Operable Unit (OU) 9.

The Tank Farm originally contained an extensive drainage system consisting of numerous catch basins, corrugated metal pipe, perforated corrugated metal pipe (PCMP), vitrified clay pipe, and reinforced concrete pipe. Portions of the drainage system were installed with PCMP to depress the water table in the Tank Farm to prevent groundwater from exerting uplift forces on the bottoms of the tanks. Both surface water and groundwater collected by the piping systems ultimately flow to the storm drain system near the Main Gate and are discharged to a boomed area of the Thames River, adjacent to the Goss Cove Landfill.

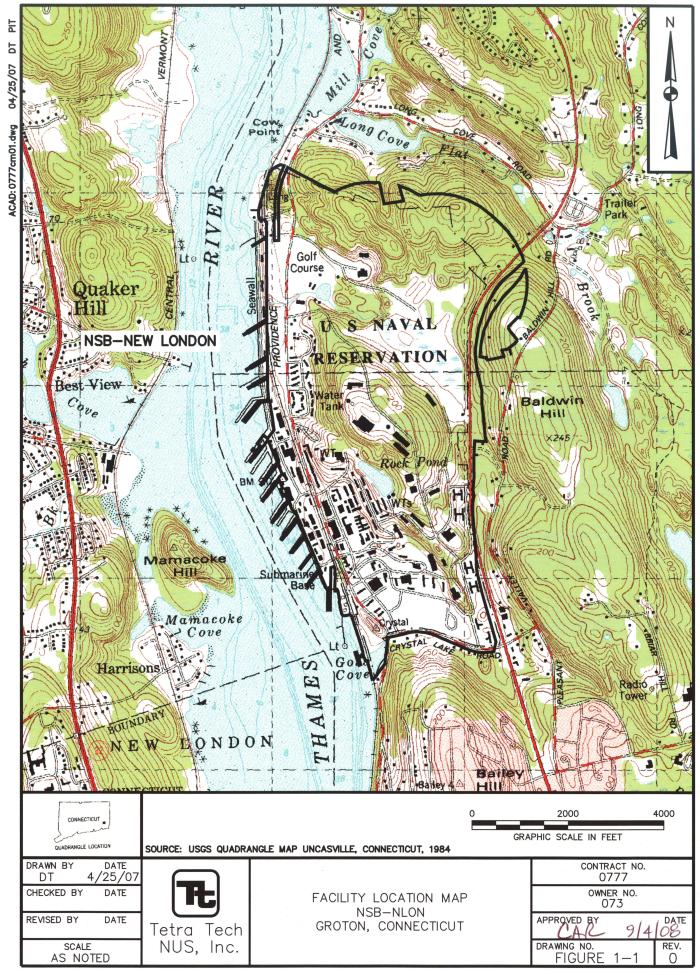
The drainage system was rehabilitated in 2000. The original combined groundwater and stormwater system was separated into a deep groundwater and a new shallow stormwater system. The groundwater underdrain collects water from the old tank ring drains (french drains). Over 2,000 feet of old deteriorated pipes in the groundwater underdrain system connecting the ring drains to the storm sewer were slip-lined to improve their integrity and conductance. A portion of the refurbished piping is shown by a dashed line on Figure 1-4. An existing manhole, initially intended to be converted into an oil/water separator, was modified to become a groundwater flow-metering pit. In the manhole, a 18-inch-diameter high-density polyethylene (HDPE) slip line was cut in half longitudinally to form a trough that could be used to meter flow. The annular space between the HDPE slip line and the old pipe was bricked and grouted with a watertight material, and the base of the structure was filled with grout to the top of the trough. Under this construction, all of the groundwater entering the metering pit flows through the trough, and the quantity of flow can be measured. The depth of the metering pit is approximately 15 feet. Field sketch FSK-003 of this structure is presented as Figure 1-5 (FWEC, 2001).

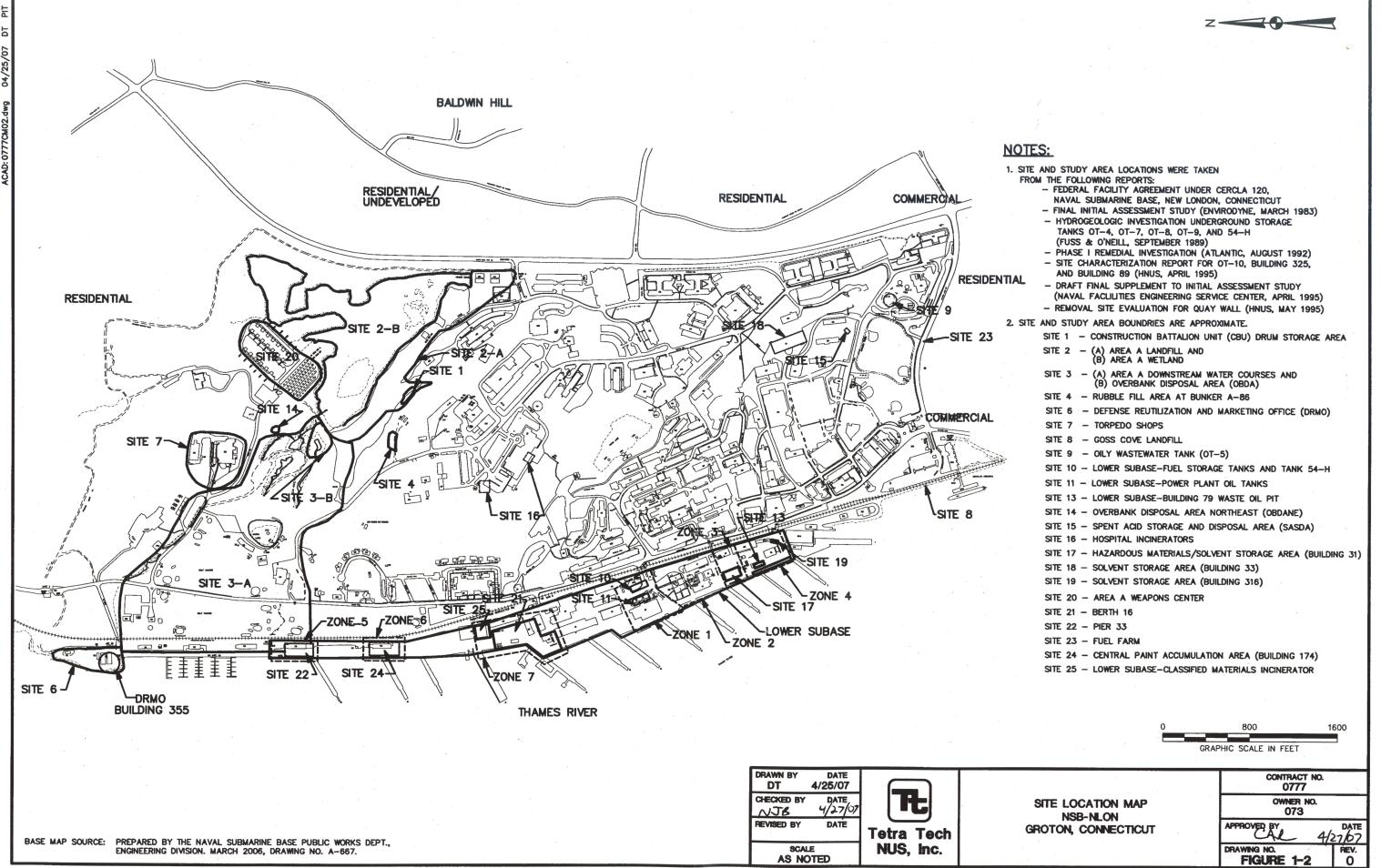
After completion of the storm sewer rehabilitation project, flow measurements were taken in the metering pit from October 4, 2000 to December 8, 2000. Daily flow rates ranged from 75,000 gallons per day (October 5, 2000) to 122,000 gallons per day (December 2, 2000). In addition, seven groundwater samples were collected from the metering pit between July 25, 2000 and May 23, 2001 and analyzed for a varying list of analytical parameters including fuel type fingerprint (Method 8015), pH (Method EPA 150.1), total petroleum hydrocarbons (TPH) (Method 418.1), oil and grease (Method EPA 413.1), total suspended solids (TSS) (Method 160.2), inorganics (Method 6010B), volatile organic compounds (VOC)

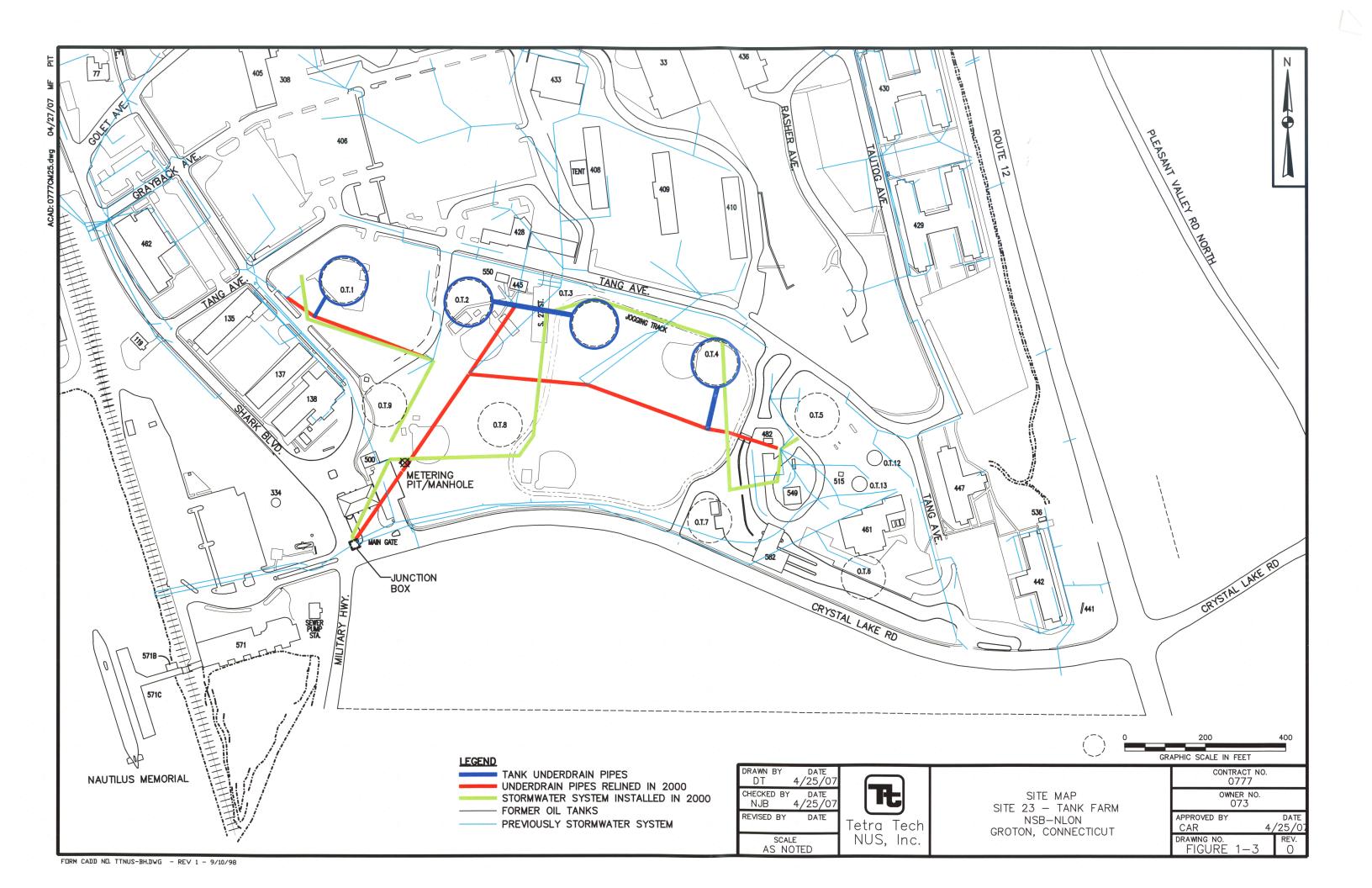
(Method OLM2.1), semivolatile organic compounds (SVOCs) (Method 8270C), and polynuclear aromatic hydrocarbons (PAHs) (Method 8310). The analytical results varied per round, and no official evaluation of data compared to Connecticut criteria was completed, but in general the results did not indicate that there were significant concentrations of contaminants typically found in fuel oil present in the groundwater.

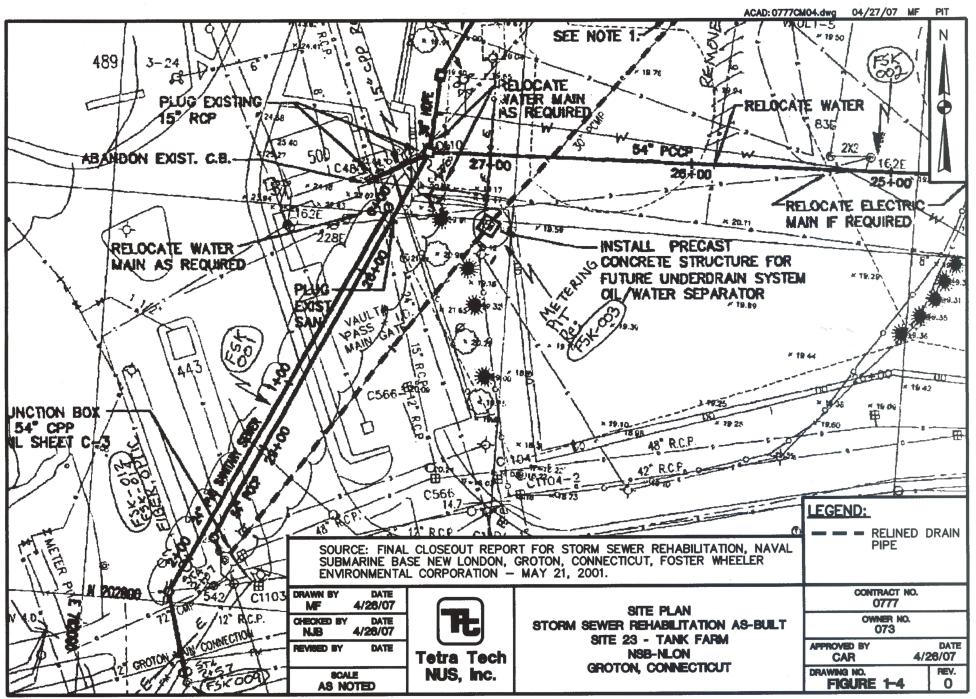
1.5 REPORT FORMAT

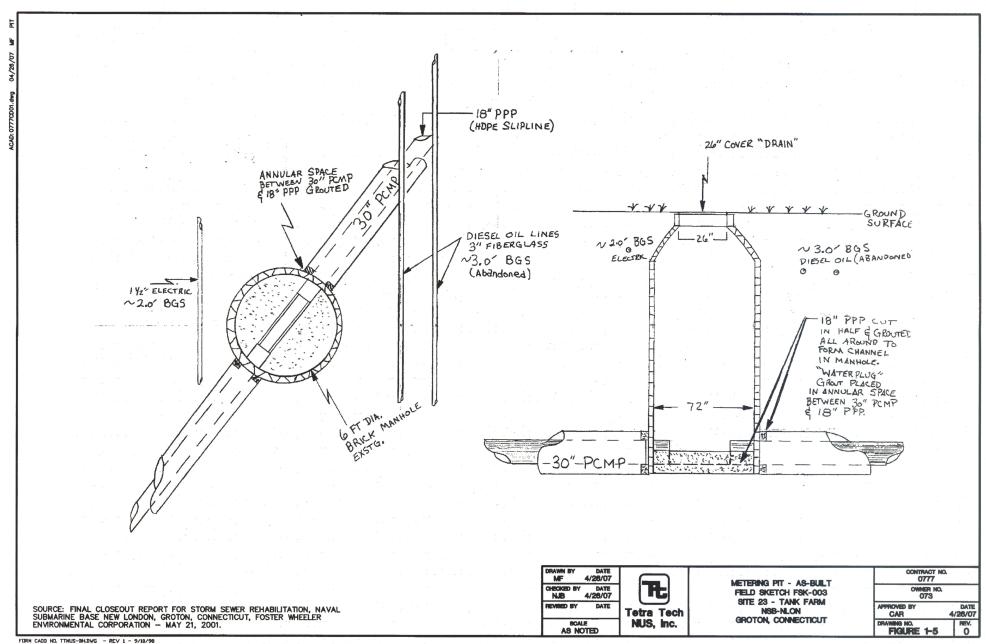
Section 1.0 of the report is this brief introduction. Section 2.0 describes the field tasks and methodologies in detail. Section 3.0 summarizes and evaluates the data collected during the Year 1 program. Conclusions and recommendations are provided in Section 4.0. Field forms (Appendix A), the Round 4 Data Validation Letter (Appendix B), analytical database (Appendix C), and human health risk assessment memoranda (Appendices D and E) are provided as appendices to this report.











2.0 FIELD WORK

Four rounds of sampling were conducted during Year 1 in accordance with the Work Plan for Site 23 Underdrain Metering Pit Sampling (Tetra Tech, 2007a). The dates of the sampling rounds are as follows:

- Round 1 June 18, 2007
- Round 2 September 6, 2007
- Round 3 December 18, 2007
- Round 4 February 21, 2008

The field work performed during the four rounds of sampling is described in the following sections.

2.1 SAMPLE COLLECTION

General field activities performed during the sampling rounds included removing the manhole cover, collecting samples from the underdrain metering pit, collecting quality assurance/quality control (QA/QC) samples, and measuring water quality parameters. The field forms associated with the Round 4 sampling effort (i.e., copies of the relevant field logbook pages, chain of custody forms, sample log sheets, and equipment calibration logs) are included in Appendix A. The field forms for Rounds 1 through 3 were previously provided in the round-specific letter reports (Tetra Tech, 2007b, 2007c, and 2008).

During Rounds 1 through 3, sampling was completed by lowering a dedicated stainless steel beaker into the manhole along the centerline of the bottom of the metering pit at a 45-degree angle, with the mouth of the beaker facing upstream. The beaker was allowed to fill, and the sample was then retrieved and transferred to the appropriate sample containers.

During Round 4, a new sampling technique was implemented in an attempt to minimize incorporation of suspended solids and iron floc into the samples. The need for the new technique was identified in the Round 3 Letter Report (Tetra Tech, 2008), and the new technique included the following steps:

- Installation of polyvinyl chloride (PVC) riser with an attached 2-foot length of screen with a slot size of 0.01 inch into the flow in the Site 23 underdrain metering pit.
- Insertion of Teflon tubing inside the PVC riser until the end of the tubing was approximately 2 inches
 off the bottom of the underdrain metering pit. Water in the pit was approximately 3 to 4 inches in
 depth.

- Use of surgical-grade silicone tubing to connect the Teflon tubing to a peristaltic pump. Purging of several hundred milliliters of water through the tubing until the water appeared clear (i.e., low turbidity).
- Adjustment of the pump rate to 200 milliliters per minute and filling of appropriate sample containers, collecting unfiltered parameters first and then dissolved parameters. A 0.45-micron in-line filter was used to filter the samples in the field. Per the recommendation provided in the Round 3 Letter Report, total and dissolved (filtered) samples were collected for PAHs and Extractable Total Petroleum Hydrocarbon (ETPH) analysis during Round 4 to evaluate the potential impact of suspended solids and/or iron floc on the analytical results.

All samples were placed on ice immediately after collection and then sent to the laboratory for analysis.

2.2 WATER QUALITY

A summary of the water quality measurements collected during the four rounds of sampling is provided in Table 2-1. The parameters that were measured and are summarized in Table 2-1 include pH, conductivity, dissolved oxygen (DO), temperature, oxidation-reduction potential (ORP), and turbidity. With a few exceptions, most of the measurements were consistent over the four rounds of measurements or varied as expected based on seasonal changes. One exception was the high conductivity measurement [5.8 milliSiemens per centimeter (mS/cm)] recorded during Round 2, which appears to be anomalous when compared to the other three rounds of data. The equipment calibration results, field notes, and manufacturer's information for the water quality probe were reviewed; however, a cause for the anomaly could not be determined. Another exception is the high DO concentration (18.26 mg/L) recorded during Round 4. It is likely that this artificially high concentration is related to oxygen being incorporated into the sample by the sampling technique (i.e., peristaltic pump) used during Round 4. The last exception is turbidity, which consistently declined over the four sampling rounds. It appears that the sampling technique steadily improved during the first three rounds of sampling, with turbidity readings decreasing from 55.6 nephelometric turbidity units (NTUs) to 3.4 NTUs. The new sampling approach used during Round 4 resulted in the lowest turbidity (2.43 NTUs) of any of the rounds and is expected to have resulted in sample results with the least impact from turbidity.

2.3 ANALYTICAL PROGRAM

After collection, the samples were packaged and shipped to the project laboratory, Katahdin Analytical Services in Scarborough, Maine, for analysis. The samples were analyzed by the laboratory for Target Compound List (TCL) VOCs, TCL SVOCs, TCL PAHs, Target Analyte List (TAL) metals (total and dissolved), oil and grease, and ETPH per the Work Plan. Per the recommendation provided in the

Round 3 Letter Report, filtered samples were also analyzed for PAHs and ETPH during Round 4 to evaluate the potential impact of suspended solids and/or iron floc on the analytical results.

2.4 QA/QC PROGRAM

Samples collected to meet QA/QC requirements included in the Work Plan were trip blanks, field duplicates, and matrix spike/matrix spike duplicate (MS/MSD). The blanks and duplicates collected and submitted during each round were identified on the chain-of-custody forms and sample log sheets. Trip blanks were included in the coolers shipped to the laboratory during Rounds 1 through 4 that contained samples for TCL VOC analysis. Trip blanks are used to assess the potential for contamination of samples to be analyzed for VOCs by contaminant migration into sample containers during sample shipment and storage. Field duplicates were collected during Rounds 1 and 3, in accordance with the Work Plan, to help identify the precision of the sampling and analysis procedures. MS/MSD samples were collected and sent to the laboratory during each round of sampling to help identify method performance and precision issues.

2.5 DECONTAMINATION

Minimal decontamination efforts were required during the field sampling program. The beaker used to collect samples during Rounds 1 through 3 was decontaminated prior to and after sampling using a potable water rinse, detergent rinse, and potable water rinse. The small quantity of decontamination fluid generated during decontamination was directly disposed into the sanitary sewer system. The Teflon tubing used to collect the water sample during Round 4 did not require decontamination. The tubing was retained to be used for additional sampling of the metering pit if required in the future. During all rounds, purge water generated during sampling was returned to the Site 23 underdrain metering pit.

TABLE 2-1

SUMMARY OF WATER QUALITY MEASUREMENTS ROUNDS 1 THROUGH 4 SAMPLING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

Round	pH (SU)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxidation- Reduction Potential (mV)	Turbidity (NTU)
1	6.18	0.709	9.00	16.63	45	55.60
2	6.61	5.8 ⁽¹⁾	4.70	17.30	15	26.00
3	5.67	0.594	4.15	13.20	52	3.40
4	6.33	0.648	18.26 ⁽²⁾	11.76	40	2.43

- 1 Result appears to be anomalous compared to the other three rounds of data. The equipment calibration results, field notes, and manufacturer's information for the water quality probe were reviewed; however, a cause for the anomaly could not be determined.
- 2 Result appears to be anomalous compared to the other three rounds of data. The peristaltic pump used during Round 4 may have caused this elevated dissolved oxygen concentration.

3.0 RESULTS

3.1 DATA VALIDATION

This section describes the data review processes used to determine whether analytical laboratory data were of acceptable technical quality for use in decision making. The review began with data validation, which is a comparison of data quality indicators (DQIs) to prescribed acceptance criteria. The DQIs are measures to assess the bias and precision of the analytical calibrations and sample analyses. The output of this review was a set of alphabetic flags such as "U," "J," "R," or combinations thereof, that may have been assigned to individual results based on the validation effort. These flags were used to infer the general quality of the data. Also evaluated were the measures of data completeness, sensitivity, comparability, and representativeness.

3.1.1 Data Validation Process

All of the results from analytical laboratory samples were validated according to several specifications. Assignment of data qualification flags conformed to United States Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) National Functional Guidelines for Low Concentration Organic Data Review (June 2001), USEPA Region 1 Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses (December 1996), and USEPA Region 1 Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (February 1989) to the greatest extent practicable for non-CLP data.

Data validation specifications require that various data qualifiers be assigned when a deficiency is detected or when a result is less than its detection limit. If no qualifier is assigned to a result that has been validated, the data user is assured that no technical deficiencies were identified during validation. The qualification flags used are defined as follows:

U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.

J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

UR – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies (e.g., holding times missed by a factor of two times the specified time limit, severe calibration non-compliances, and extremely low analyte recoveries).

R – Indicates that the chemical may or may not be present. The positive analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies.

The preceding data qualifiers may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data and qualification with UR or R data validation qualifiers. These data are considered invalid and are not used for decision-making purposes unless they are used in a qualitative way and the use is justified and documented. Minor problems are defined as issues resulting in the estimation of data and qualification with U, J, and UJ data validation qualifiers. Estimated analytical results are considered to be suitable for decision-making purposes unless the data use requirements are very stringent and the qualifier indicates a deficiency that is incompatible with the intended data use. A U qualifier does not necessarily indicate that a data deficiency exists because all non-detect values are flagged with the U qualifier regardless of whether a quality deficiency has been detected.

3.1.2 Data Validation Outputs

After data were validated, a list was developed of non-conformities requiring data qualifier flags that were used to alert the data user to inaccurate or imprecise data. For situations in which several QC criteria were out of specification, the data validator made professional judgments and/or comments on the validity of the overall data package. The reviewer then prepared a technical memorandum presenting qualification of the data, if necessary, and the rationale for making such qualifications. The net result was a data package that had been carefully reviewed for its adherence to prescribed technical requirements. Pertinent quality estimates are summarized in a more quantitative format in the following section.

3.1.3 <u>Data Quality Review</u>

DQIs are parameters that are monitored to help establish the quality of data generated during an investigation. Some of the DQIs are generated from analysis of field samples (e.g., field duplicates) and

some are generated from the analysis of laboratory samples (e.g., laboratory duplicates). Individually, field and laboratory DQIs provide measures of the performance of the respective investigative operations (field or laboratory). During data validation, individual QC results were evaluated. If individual QC results were acceptable, no validation flag was assigned to an analytical result; otherwise, a flag indicating the type of QC deficiency was assigned to the result. Table 3-1 lists all the data that were rejected and the reasons for the rejections. This data is considered un-useable for any purposes. The semivolatile compound pentachlorophenol is considered a poor responder, and several calibrations failed due to low pentachlorophenol response. Table 3-2 lists all the data that were qualified and the reasons for the qualification. The qualified data from Table 3-2 are useable for their intended purpose.

3.1.4 Completeness

Completeness is a measure of the number of valid samples or measurements that are available relative to the number of samples or measurements that were intended to be generated. For this project, completeness was measured on two different bases, samples collected and laboratory measurements, as follows:

- Sample completeness was a measure of the usable samples collected compared to those intended to be collected.
- Laboratory measurement completeness was a measure of the amount of usable, valid, laboratory measurements obtained for each target analyte.

Usable, valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to not have been disqualified for use through data validation or additional data review. Completeness was determined using the following equation:

$$%C = \frac{V}{T} \times 100$$

where %C = percent completeness

V = number of samples (or results) determined to be valid

T = total number of planned samples (or results)

All samples proposed were collected during all four sampling rounds. The percent completeness (%C) for laboratory measurement for all analytical fractions for all four rounds was 100, with the exception of SW-846 Methods 8270C and 8270C-SIM. One 4-nitroaniline and six pentachlorophenol data points were

rejected. With the seven rejected semivolatile data points, the laboratory completeness for semivolatiles was approximately 98 percent, which is still greater than the 90 percent quality control level.

3.1.5 <u>Sensitivity</u>

The method detection limits (MDLs) reported by the laboratory were less than the action limits specified for the Connecticut Remediation Standards Regulations (RSRs) (January 1996 and October 24, 2005) and NSB-NLON General Permit for the Discharge of Stormwater Associated with Industrial Activity (DEP-PERD-GP-014, Issuance Date: October 1, 2002 and Modified Date: July 15, 2003). Therefore, sensitivity specifications were not adversely affected for this project, and data quality objectives were met.

3.1.6 Laboratory Accuracy

Accuracy in the laboratory is measured through the comparison of a spiked sample or laboratory control sample (LCS) result to a known or calculated value and is expressed as a percent recovery (%R). It was also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that were analyzed by organic chromatographic methods. LCSs were used to assess the accuracy of laboratory operations with minimal sample matrix effects. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCS and MS analyses were performed at a frequency of one per 20 associated samples. Laboratory accuracy was assessed by comparing calculated %R values to accuracy control limits specified by the laboratory.

Percent recovery is calculated using the following equation:

$$%R = \frac{(S_s - S_o)}{S} \times 100$$

where %R = percent recovery

 S_s = result of spiked sample

S_o = result of non-spiked sample

S = concentration of spiked amount.

All MS/MSD recovery, LCS/LCS duplicate(LCSD) recovery, and surrogate recovery non-compliances that resulted in qualification of data are presented in Table 3-2. Although data are qualified due to MS/MSD, LCS/LCSD, and surrogate recovery non-compliances, this is not expected to adversely affect data quality because the data are still useable for risk assessment. Three pentachlorophenol data points were rejected due to MS/MSD, LCS/LCSD, and/or surrogate recoveries less than 10 percent. These data are

not useable for risk assessment because of low bias, and its affect on data quality will be assessed in the risk assessment section of this report.

3.1.7 Laboratory Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions.

Precision for chemical parameters is expressed as a relative percent difference (RPD), which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs, typically expressed as percentages, are used to evaluate both field and laboratory duplicate precision and are calculated as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where RPD = relative percent difference

V1, V2 = two results obtained by analyzing duplicate samples

The precision estimates obtained from duplicate field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

Field duplicate imprecision was noted for several parameters in several samples in Table 3-2. However, none of these field duplicate non-compliances resulted in rejection of the data. All MS/MSD, LCS/LCSD, and field duplicate precision data are considered useable for risk assessment.

3.1.8 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods, and standardized data reporting formats. Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with previous data and with

current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the QA plan.

Calibration non-compliances occurred in the volatile, semivolatile, and metals fractions for several samples. Six of the seven rejected data points are due to poor instrument response for semivolatile compounds 4-nitroaniline and pentachlorophenol. These compounds are considered poor responders by SW-846 Method 8270C. The low instrument responses for 4-nitroaniline and pentachlorophenol indicate a low bias, and positive results for these compounds at the low end of the calibration curve may not be detected.

3.1.9 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site.

The Site 23 Underdrain Metering Pit Sampling Work Plan (Tetra Tech, 2007a) and the use of standardized sampling, sample handling, sample analysis, and data reporting procedures were designed so that the final data would be accurate representations of actual site conditions. It is believed that all reported data are adequately representative of site conditions.

3.2 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Table 3-3 summarizes the actual detection limits achieved by the laboratory that analyzed the Year 1 groundwater samples. By comparing the required and achieved detection limits, it is evident that the analyses performed by the project laboratory met the project requirements (i.e., achieved detection limits less than remedial goals and monitoring criteria).

3.3 ANALYTICAL DATA EVALUATION

The results of the underdrain metering pit sampling events are discussed below. The analytical results for the February 2008 sampling event are provided in Appendix B. The analytical results for Rounds 1 through 3 were previously provided in their respective quarterly reports (Tetra Tech, 2007b, 2007c, and 2008). The analytical data for all Year 1 quarterly sampling events are summarized in Table 3-3 and Appendix C.

Round 1

Seven VOCs (bromodichloromethane, chloroform, cis-1,2-dichloroethene, isopropylbenzene, methyl tert-butyl ether (MTBE), tetrachloroethene, and trichloroethene), one PAH (2-methylnaphthalene), 10 metals (aluminum, barium, calcium, iron, lead, magnesium, manganese, potassium, sodium, and zinc),

and ETPH were detected during the Round 1 event in either the original or duplicate sample. The original sample and duplicate sample concentrations were comparable, with the exception of bromodichloromethane and selenium. Bromodichloromethane was detected in the original sample and not in the duplicate sample. Selenium was detected in the filtered and unfiltered duplicate sample for metals and not in the original sample. None of the detected concentrations exceeded any established CTDEP criteria.

Because all Round 1 concentrations were in compliance with criteria, it was concluded that the groundwater does not represent a significant risk to human health or the environment under current conditions.

Round 2

Six VOCs (cyclohexane, cis-1,2-dichloroethene, isopropylbenzene, MTBE, tetrachloroethene, and trichloroethene), no PAHs, 15 metals (aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, silver, sodium, vanadium, and zinc), and ETPH were detected during the Round 2 event. All of the Round 2 results were in compliance with CTDEP criteria except for arsenic in the unfiltered sample. Arsenic was detected at a concentration of 13.9 micrograms per liter (µg/L) in the unfiltered sample, which exceeds the surface water protection criterion (4 µg/L). However, arsenic was detected at 1.2 µg/L in the filtered sample, which is less than the criteria, and was not detected at similar concentrations in previous or subsequent sampling events. Because the arsenic concentration detected in the filtered sample was significantly less than the concentration detected in the unfiltered sample, it is likely that the unfiltered arsenic concentration is a result of suspended solid particles in the water and is not indicative of groundwater quality. Therefore, because all of the filtered sample concentrations were in compliance with criteria, it was concluded that the groundwater did not represent a significant risk to human health or the environment.

Round 3

Four VOCs (cis-1,2-dichloroethene, MTBE, tetrachloroethene, and trichloroethene), 20 PAHs (1-methylnaphthalene, 2-methylnaphthalene, 4-nitroaniline, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(g,h,i)perylene, benzo(k)flouranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, hexachlorobenzene, hexachlorobutadiene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene), 12 metals (aluminum, barium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, and zinc), and ETPH were detected during the Round 3 event. Round 3 was the only event which PAHs were detected at significant concentrations. Concentrations were less than criteria except for seven PAH concentrations as shown in Table 3-3. Concentrations of PAHs exceeded Surface Water Protection Criteria but were all low (approx.

1 µg/L or less). Similar concentrations of PAHs were detected once before in May 2001 during a series of four sampling rounds conducted by another Navy contractor after the metering pit was installed. Although 21 PAHs were detected in sample S23GWMPM-03, only three PAHs were detected in the field duplicate sample, and none of those detections exceeded of Surface Water Protection Criteria. The discrepancy between the original sample and field duplicate may indicate that the PAH results are not truly indicative of groundwater quality. The sample collection technicians have noted that an orange/rust colored floc forms in the bottom of the manhole between sampling events. Every attempt is made to limit collection of the floc with the groundwater; however, it is thought that the sampling technique disturbed the floc, which resulted in sediment particles being collected with the aqueous sample. The PAHs could then have been bound to the sediment particles. Both filtered and unfiltered samples were collected for inorganics analysis because it was anticipated that sediment particles in the aqueous samples may be problematic. The inorganic data show that there have been fewer detections of metals in filtered samples than in unfiltered samples, which suggests that sediment particles are present to some extent.

Based on the discrepancy between the original sample and field duplicate results and the low levels of PAHs detected, it was concluded that the PAH results were not indicative of groundwater quality and that the groundwater does not represent a significant risk to human health or the environment. To confirm that the PAH results are related to sediment particles, it was recommended that both total and filtered PAH samples be collected during the Round 4 sampling event.

A discrepancy between the original and field duplicate results for ETPH was also identified. The original sample result for ETPH was non-detect; however, the concentration in the field duplicate was 1600 μ g/L, which also supports the possibility that sediment particles could be affecting the results. The detection of ETPH in the field duplicate was less than the allowable concentration listed in the general stormwater permit of 2,500 μ g/L (for oil and grease).

In addition to the discrepancy between sample and duplicate results for hexachlorobenzene (1.2 μ g/L and 0.2 U μ g/L), as was the case for many PAHs, it was noted during Round 3 that the detection limit for hexachlorobenzene in the duplicate sample was greater than the Connecticut Surface Water Protection Criterion (0.077 μ g/L). The reported detection limit (0.2 μ g/L) is the practical quantitation limit (PQL) for Method SW-846 8270C SIM performed by the project laboratory. This method is typically used by commercial laboratories to obtain the lowest possible detection limit. Therefore, because the Surface Water Protection Criteria (0.077 μ g/L) is approximately one order of magnitude less than the PQL, current technology available to commercial laboratories is not able to reach the required detection limit. According to 22a-133k-3(f)(4)(B) of the Connecticut RSRs, compliance with groundwater criterion can be shown when the detected concentration is less than the lowest concentration that can be consistently and accurately quantified (i.e., the lowest detection limit achievable by current analytical methods). Therefore,

it was concluded that the $0.2 \mu g/L$ detection limit could be used as a surrogate Surface Water Protection Criterion for hexachlorobenzene.

Because of the anomalous Round 3 results, the impact of Site 23 groundwater on human health and the environment was inconclusive.

Round 4

Five VOCs (benzene, cis-1,2-dichloroethene, MTBE, tetrachloroethene, and trichloroethene) and 12 metals (aluminum, arsenic, barium, calcium, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, and zinc) were detected during the Round 4 sampling event. None of the detected concentrations exceeded any established Connecticut criteria.

Both filtered and unfiltered samples were collected for PAH and ETPH analysis during Round 4 to verify Round 3 results suspected to be related to suspended sediment particles. Fewer PAHs were detected during Round 4 than Round 3 and four of five PAH concentrations detected during Round 4 were less than Round 3 concentrations. Unlike Round 3 when seven PAHs were detected above established CTDEP criteria, the PAH concentrations detected during Round 4 did not exceed any established CTDEP criteria. ETPH was not detected in either the unfiltered or filtered sample during Round 4 compared to a detection of 1,600 µg/L during Round 3. The Round 4 PAH and ETPH results were also similar to the data collected during Rounds 1 and 2, which supports the theory that the Round 3 results were anomalous. However, it should be noted that during Round 4, no PAHs were detected in the unfiltered sample, but five PAHs were detected in the filtered sample. This data suggests that a factor (e.g., filter, bottleware, or laboratory equipment) other than suspended sediment particles contributed to the PAHs detected during Round 4. A similar factor may have caused the anomalous Round 3 results. Therefore, the Round 4 results suggest that a factor other than suspended sediments in the sample may have caused the anomalous results during Round 3.

Therefore, because all of the Round 4 sample concentrations were in compliance with the criteria, it was concluded that groundwater does not represent a significant risk to human health or the environment under current conditions.

3.4 STATISTICAL/TREND ANALYSIS

It was anticipated that statistical or trend analysis would be performed for the Site 23 data; however, because of the limited number of contaminants detected and the inconsistent/infrequent detection of chemicals in excess of criteria, no statistical or trend analysis is warranted. This type of analysis may be performed in the future if additional data are collected and the results indicate the need for the analysis.

3.5 MEMORANDUM REGARDING HUMAN HEALTH RISKS ASSOCIATED WITH SITE 23 GROUNDWATER (MAY 19, 2008)

The following section summarizes the human health risk assessment (HHRA) memoranda that were completed to evaluate potential for adverse impacts on human health resulting from exposure to contaminated groundwater at Site 23. The complete memorandum is provided in Appendix D.

Historical and current information pertaining to Site 23 groundwater were reviewed to determine if Site 23 groundwater poses a threat to human health and the environment. Historical information reviewed as part of the evaluation included the Basewide Groundwater Operable Unit Remedial Investigation Report (BGOURI) (Tetra Tech, 2002) and data collected as part of the storm sewer rehabilitation (FWEC, 2001). Current data reviewed included the year of underdrain metering pit data collected through February 2008. USEPA and CTDEP guidance updated since the BGOURI were used in the evaluation.

The conclusions of the evaluation are as follows:

- The Human Health Risk Assessment (HHRA) performed during the BGOURI evaluated potential risks from exposures to groundwater by construction workers and hypothetical residents, although it is unlikely that direct contact exposures to Site 23 groundwater would occur based on current and expected future site use. Cumulative risks were less than or within USEPA and CTDEP acceptable levels. However, chemical-specific risks for tetrachloroethene exceeded the CTDEP target level for individual chemicals, although the maximum detected concentration of tetrachloroethene was less than its CTDEP Remediation Standard Regulations (RSR) (5 μg/L). Concentrations of tetrachloroethene in Site 23 groundwater have decreased from 3 μg/L in the BGOURI to 0.3 μg/L during Round 4 sampling. Chemical-specific risks associated with tetrachloroethene would now be less than the CTDEP target level for individual chemicals.
- Human Health Risk Assessment guidance has been revised since the BGOURI HHRA was prepared but the changes in the guidance would not change the conclusions of the HHRA.
- Concentrations of chemicals in groundwater samples after the storm sewer rehabilitation were greatest in samples collected in August and October 2000, right after completion of construction and decreased significantly in subsequent sampling rounds.
- Concentrations of all chemicals detected in groundwater during the first year of the underdrain metering pit sampling were less than CTDEP Surface Water Protection and Volatilization Criteria with the exception of arsenic and several PAHs. The concentration of total arsenic in the Round 2 sample

exceeded the Surface Water Protection Criteria although the concentration of arsenic in the filtered sample was less than the Surface Water Protection Criterion. The arsenic detected in the unfiltered sample is believed to be a result of suspended solid particles in the water and the filtered sample is more indicative of groundwater quality. Concentrations of acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, hexachlorobenzene, and phenanthrene exceeded the Surface Water Protection Criterion. These chemicals were not detected in the duplicate sample collected in Round 3 and these chemicals were not detected in the Round 4 sample.

- In general, concentrations of chemicals in Site 23 groundwater have decreased over time except as noted above.
- Potential risks for construction workers exposed to Site 23 groundwater are still acceptable using the
 analytical results from the four rounds of quarterly sampling. Potential risks for hypothetical residents
 exposed to Site 23 groundwater exceed acceptable levels, although Site 23 is not suitable for
 residential development.

Based on existing information, under current and expected land use, Site 23 groundwater does not pose a significant threat to human health or the environment. Adverse health effects are possible under hypothetical residential land use.

3.6 MEMORANDUM REGARDING VAPOR INTRUSION EVALUATION FOR GROUNDWATER AT OPERABLE UNIT 9 (MAY 30, 2008)

Groundwater data from Site 23, which is within operable unit (OU) 9, was evaluated to determine if there were unacceptable risks associated with vapor intrusion into buildings. The complete memorandum for OU9 is provided in Appendix E. Data from a total of eight sites (i.e., 2, 3, 7, 14, 15, 18, 20, and 23) were evaluated in the memorandum, but only the risk results for Site 23, which are called out in separate sections of the memorandum, are applicable to this report.

The most recent groundwater data that was available for the site were used in the evaluation. Concentrations of volatile organic compounds (VOCs) in groundwater were compared to screening criteria for vapor intrusion. Screening criteria were obtained from USEPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002, CTDEP's Proposed Revisions - Connecticut's Remediation Standard Regulations Volatilization Criteria, March 2003, and USEPA Region I (USEPA, 2008). The screening criteria are for residential exposures and are based on an incremental lifetime cancer risk (ILCR) of 1 x 10⁻⁶ or a hazard index (HI) of 1. If the risk-based screening criterion is less than the Maximum

Contaminant Level (MCL) the 2002 EPA guidance recommends using the MCL as the screening level. However, USEPA Region I guidance does not allow for MCLs to be used as screening criteria. USEPA Region I provided risk-based screening levels for those cases where the USEPA draft guidance recommended MCLs as screening levels. If chemicals were detected at concentrations exceeding either screening criteria, the chemicals were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model.

Year 1 quarterly groundwater data were used to evaluate the potential for vapor intrusion at Site 23. Concentrations of chloroform detected in one sample and trichloroethene detected in four samples exceeded the USEPA screening criteria. Therefore, chloroform and trichloroethene were further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Residential exposures, at Site 23 the ILCR for chloroform of 2 x 10^{-6} and trichloroethene of 4 x 10^{-6} based on the draft USEPA toxicity criteria are less than the CTDEP acceptable level for cumulative exposures but exceed the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. The ILCR for trichloroethene for residential exposures based on the California Environmental Protection Agency (Cal EPA) toxicity value and ILCRs for industrial exposures for trichloroethene and vinyl chloride are all less than 1 x 10^{-6} . Also the maximum detected concentration of chloroform in groundwater samples at Site 23 of 3 μ g/L is less than the residential CTDEP RSR of 26 μ g/L for vapor intrusion.

Modeling results showed that cancer risks for chloroform under a residential scenario were within USEPA acceptable levels but exceeded CTDEP acceptable levels. Cancer risks for trichloroethene based upon California EPA toxicity criteria were within USEPA and CTDEP acceptable levels for residential and industrial scenarios but cancer risks for a residential scenario based on draft USEPA toxicity criteria exceeded CTDEP acceptable levels. Further Applicable or Relevant and Appropriate Requirements (ARARs) showed that vapor intrusion is not an issue at Site 23. No further action is required for vapor intrusion issues.

TABLE 3-1

DATA REJECTION AND REASONS FOR REJECTIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM-03-D	4-NITROANILINE	1	UR	С	Calibration non-compliance.
S23GWMPM01	PENTACHLOROPHENOL	1	UR	CDE	Calibration non-compliance, MS/MSD recovery noncompliance, and LCS/LCSD recovery non-compliance.
S23GWMPM01-D	PENTACHLOROPHENOL	1	UR	CE	Calibration non-compliance and LCS/LCSD recovery non-compliance.
S23GWMPM02	PENTACHLOROPHENOL	1	UR	С	Calibration non-compliance.
S23GWMPM-03	PENTACHLOROPHENOL	1	UR	С	Calibration non-compliance
S23GWMPM-03-D	PENTACHLOROPHENOL	1	UR	С	Calibration non-compliance
S23GWMPM04	PENTACHLOROPHENOL	1	UR	R	Surrogate recovery non-compliance.

MS/MSD = Matrix spike/matrix spike duplicate LCS/LCSD = Laboratory control sample/LCS duplicate

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 1 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM01	2,4-DIMETHYLPHENOL	10	UJ	D	MS/MSD recovery non-compliance
S23GWMPM01	2,4-DINITROPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM01	2-METHYLNAPHTHALENE	0.17	J	Р	Uncertainty near the detection limit.
S23GWMPM01	4-NITROPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM01	ALUMINUM	20.4	J	Р	Uncertainty near the detection limit.
S23GWMPM01	ANTIMONY	2.3	U	A	Laboratory blank contamination.
S23GWMPM01	ARSENIC	3.7	U	A	Laboratory blank contamination.
S23GWMPM01	ARSENIC	3.5	U	A	Laboratory blank contamination.
S23GWMPM01	BENZO(A)PYRENE	0.2	UJ	D	MS/MSD recovery non-compliance
S23GWMPM01	BENZO(G,H,I)PERYLENE	0.2	UJ	D	MS/MSD recovery non-compliance
S23GWMPM01	BENZO(K)FLUORANTHENE	0.2	UJ	С	Calibration non-compliance.
S23GWMPM01	BIS(2-ETHYLHEXYL)PHTHALATE	1	UJ	CD	Calibration non-compliance and MS/MSD recovery non-compliance
S23GWMPM01	BROMODICHLOROMETHANE	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM01	CHLOROETHANE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01	CHLOROFORM	3	J	G	Field duplicate imprecision.
S23GWMPM01	CHROMIUM	0.94	U	A	Laboratory blank contamination.
S23GWMPM01	CHROMIUM	1.2	U	A	Laboratory blank contamination.
S23GWMPM01	CIS-1,2-DICHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM01	COBALT	0.84	U	A	Laboratory blank contamination.
S23GWMPM01	COBALT	0.67	U	Α	Laboratory blank contamination.
S23GWMPM01	COPPER	3	U	A	Laboratory blank contamination.
S23GWMPM01	COPPER	14.9	U	Α	Laboratory blank contamination.
S23GWMPM01	DIBENZO(A,H)ANTHRACENE	0.2	UJ	D	MS/MSD recovery non-compliance
S23GWMPM01	DI-N-OCTYL PHTHALATE	10	UJ	С	Calibration non-compliance.
S23GWMPM01	INDENO(1,2,3-CD)PYRENE	0.2	UJ	D	MS/MSD recovery non-compliance
S23GWMPM01	ISOPROPYLBENZENE	0.1	J	Р	Uncertainty near the detection limit.
S23GWMPM01	LEAD	1.3	J	Р	Uncertainty near the detection limit.
S23GWMPM01	MERCURY	0.03	U	Α	Laboratory blank contamination.
S23GWMPM01	MERCURY	0.03	U	Α	Laboratory blank contamination.
S23GWMPM01	METHYLENE CHLORIDE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01	NICKEL	1	U	Α	Laboratory blank contamination.
S23GWMPM01	NICKEL	1.1	U	A	Laboratory blank contamination.
S23GWMPM01	TETRACHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM01	THALLIUM	0.99	U	A	Laboratory blank contamination.
S23GWMPM01	THALLIUM	1.2	U	Α	Laboratory blank contamination.
S23GWMPM01	TPH (C09-C36)	55	J	Р	Uncertainty near the detection limit.
S23GWMPM01	TRICHLOROETHENE	0.4	J	Р	Uncertainty near the detection limit.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 2 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM01	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01	VANADIUM	1.3	U	A	Laboratory blank contamination.
S23GWMPM01	VANADIUM	0.7	U	A	Laboratory blank contamination.
S23GWMPM01	ZINC	21.3	J	С	Calibration non-compliance.
S23GWMPM01	ZINC	21.4	J	С	Calibration non-compliance
S23GWMPM01-D	2,4-DINITROPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM01-D	2-METHYLNAPHTHALENE	0.16	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	4-NITROPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM01-D	ALUMINUM	36.7	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	ANTIMONY	1.5	U	A	Laboratory blank contamination.
S23GWMPM01-D	ANTIMONY	1.6	U	A	Laboratory blank contamination.
S23GWMPM01-D	ARSENIC	3	U	A	Laboratory blank contamination.
S23GWMPM01-D	ARSENIC	2.2	U	Α	Laboratory blank contamination.
S23GWMPM01-D	BENZO(K)FLUORANTHENE	0.2	UJ	С	Calibration non-compliance.
S23GWMPM01-D	BIS(2-ETHYLHEXYL)PHTHALATE	1	UJ	С	Calibration non-compliance.
S23GWMPM01-D	CHLOROETHANE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01-D	CHLOROFORM	2	J	G	Field duplicate imprecision.
S23GWMPM01-D	CHROMIUM	0.81	U	A	Laboratory blank contamination.
S23GWMPM01-D	CHROMIUM	0.44	U	А	Laboratory blank contamination.
S23GWMPM01-D	CIS-1,2-DICHLOROETHENE	0.2	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	COBALT	0.64	U	А	Laboratory blank contamination.
S23GWMPM01-D	COBALT	0.86	U	A	Laboratory blank contamination.
S23GWMPM01-D	COPPER	3	U	A	Laboratory blank contamination.
S23GWMPM01-D	COPPER	2.2	U	A	Laboratory blank contamination.
S23GWMPM01-D	DI-N-OCTYL PHTHALATE	10	UJ	С	Calibration non-compliance.
S23GWMPM01-D	ISOPROPYLBENZENE	0.09	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	LEAD	1.8	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	MERCURY	0.04	U	A	Laboratory blank contamination.
S23GWMPM01-D	MERCURY	0.04	U	A	Laboratory blank contamination.
S23GWMPM01-D	METHYLENE CHLORIDE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01-D	NICKEL	0.77	U	A	Laboratory blank contamination.
S23GWMPM01-D	NICKEL	0.88	U	Α	Laboratory blank contamination.
S23GWMPM01-D	SELENIUM	2	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	SELENIUM	1.7	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	TETRACHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM01-D	THALLIUM	2.3	Ü	А	Laboratory blank contamination.
S23GWMPM01-D	THALLIUM	0.93	U	А	Laboratory blank contamination.
S23GWMPM01-D	TRICHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 3 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM01-D	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM01-D	VANADIUM	1.4	U	Α	Laboratory blank contamination.
S23GWMPM01-D	VANADIUM	0.56	U	A	Laboratory blank contamination.
S23GWMPM01-D	ZINC	19.5	J	С	Calibration non-compliance.
S23GWMPM02	2,4,6-TRICHLOROPHENOL	10	UJ	D	MS/MSD recovery non-compliance
S23GWMPM02	2,4-DIMETHYLPHENOL	10	UJ	D	MS/MSD recovery non-compliance
S23GWMPM02	2,4-DINITROPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM02	2-CHLOROPHENOL	10	UJ	D	MS/MSD recovery non-compliance
S23GWMPM02	4,6-DINITRO-2-METHYLPHENOL	25	UJ	С	Calibration non-compliance.
S23GWMPM02	4-NITROANILINE	1	UJ	С	Calibration non-compliance.
S23GWMPM02	ALUMINUM	21.3	J	Р	Uncertainty near the detection limit.
S23GWMPM02	ARSENIC	1.2	J	Р	Uncertainty near the detection limit.
S23GWMPM02	BUTYL BENZYL PHTHALATE	10	UJ	С	Calibration non-compliance.
S23GWMPM02	CADMIUM	0.64	U	A	Laboratory blank contamination.
S23GWMPM02	CHROMIUM	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM02	CIS-1,2-DICHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.
S23GWMPM02	COBALT	0.47	J	Р	Uncertainty near the detection limit.
S23GWMPM02	COPPER	0.7	U	A	Laboratory blank contamination.
S23GWMPM02	CYCLOHEXANE	0.1	J	Р	Uncertainty near the detection limit.
S23GWMPM02	ISOPROPYLBENZENE	0.1	J	Р	Uncertainty near the detection limit.
S23GWMPM02	LEAD	1.1	U	A	Laboratory blank contamination.
S23GWMPM02	METHYL TERT-BUTYL ETHER	0.4	J	Р	Uncertainty near the detection limit.
S23GWMPM02	NICKEL	0.78	J	Р	Uncertainty near the detection limit.
S23GWMPM02	SELENIUM	2.4	U	A	Laboratory blank contamination.
S23GWMPM02	TETRACHLOROETHENE	0.4	J	Р	Uncertainty near the detection limit.
S23GWMPM02	THALLIUM	0.98	U	A	Laboratory blank contamination.
S23GWMPM02	THALLIUM	1.7	U	Α	Laboratory blank contamination.
S23GWMPM02	TPH (C09-C36)	140	J	D	MS/MSD recovery non-compliance
S23GWMPM02	TRICHLOROETHENE	0.5	J	Р	Uncertainty near the detection limit.
S23GWMPM-03	1-METHYLNAPHTHALENE	0.96	J	D	MS/MSD recovery non-compliance
S23GWMPM-03	2,2'-OXYBIS(1-CHLOROPROPANE)	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2,4,5-TRICHLOROPHENOL	25	UJ	Н	Holding time exceedance.
S23GWMPM-03	2,4,6-TRICHLOROPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2,4-DICHLOROPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2,4-DIMETHYLPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM-03	2,4-DINITROPHENOL	25	UJ	Н	Holding time exceedance.
S23GWMPM-03	2,4-DINITROTOLUENE	10	UJ	Н	Holding time exceedance.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 4 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (μG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM-03	2,6-DINITROTOLUENE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2-CHLORONAPHTHALENE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2-CHLOROPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM-03	2-METHYLNAPHTHALENE	1.1	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	2-METHYLPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	2-NITROANILINE	25	UJ	Н	Holding time exceedance.
S23GWMPM-03	2-NITROPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	3&4-METHYLPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM-03	3,3'-DICHLOROBENZIDINE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	3-NITROANILINE	25	UJ	СН	Calibration non-compliance and holding time exceedance.
S23GWMPM-03	4,6-DINITRO-2-METHYLPHENOL	25	UJ	Н	Holding time exceedance.
S23GWMPM-03	4-BROMOPHENYL PHENYL ETHER	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	4-CHLORO-3-METHYLPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	4-CHLOROANILINE	10	UJ	СН	Calibration non-compliance and holding time exceedance.
S23GWMPM-03	4-CHLOROPHENYL PHENYL ETHER	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	4-NITROANILINE	0.75	J	CDP	Calibration non-compliance, MS/MSD recovery non-compliance, and uncertainty near the detection limit.
S23GWMPM-03	4-NITROPHENOL	25	UJ	СН	Calibration non-compliance and holding time exceedance.
S23GWMPM-03	ACENAPHTHENE	0.83	J	G	Field duplicate imprecision.
S23GWMPM-03	ACENAPHTHYLENE	0.9	J	G	Field duplicate imprecision.
S23GWMPM-03	ANTHRACENE	0.92	J	G	Field duplicate imprecision.
S23GWMPM-03	ANTIMONY	1.8	U	A	Laboratory blank contamination.
S23GWMPM-03	ARSENIC	2.2	U	A	Laboratory blank contamination.
S23GWMPM-03	ARSENIC	1.9	U	A	Laboratory blank contamination.
S23GWMPM-03	BENZO(A)ANTHRACENE	1	J	G	Field duplicate imprecision.
S23GWMPM-03	BENZO(A)PYRENE	0.35	J	D	MS/MSD recovery non-compliance
S23GWMPM-03	BENZO(B)FLUORANTHENE	0.64	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	BENZO(K)FLUORANTHENE	0.53	J	D	MS/MSD recovery non-compliance
S23GWMPM-03	BIS(2-CHLOROETHOXY)METHANE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	BIS(2-CHLOROETHYL)ETHER	10	UJ	Н	Holding time exceedance.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 5 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM-03	BUTYL BENZYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	CARBAZOLE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	CHRYSENE	0.76	J	G	Field duplicate imprecision.
S23GWMPM-03	CIS-1,2-DICHLOROETHENE	0.2	J	Р	Uncertainty near the detection limit.
S23GWMPM-03	COPPER	0.44	U	A	Laboratory blank contamination.
S23GWMPM-03	DIBENZO(A,H)ANTHRACENE	0.14	J	DP	MS/MSD recovery non-compliance and uncertainty near the detection limit.
S23GWMPM-03	DIBENZOFURAN	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	DIETHYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	DIMETHYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	DI-N-BUTYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	DI-N-OCTYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	FLUORANTHENE	1.1	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	FLUORENE	0.97	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	HEXACHLOROBENZENE	1.2	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	HEXACHLOROBUTADIENE	0.64	J	DP	MS/MSD recovery non-compliance and uncertainty near the detection limit.
S23GWMPM-03	HEXACHLOROCYCLOPENTADIENE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	HEXACHLOROETHANE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	ISOPHORONE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	LEAD	2.5	U	Α	Laboratory blank contamination.
S23GWMPM-03	LEAD	2.1	U	A	Laboratory blank contamination.
S23GWMPM-03	NAPHTHALENE	1	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	NITROBENZENE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	N-NITROSO-DI-N-PROPYLAMINE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	N-NITROSODIPHENYLAMINE	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	OIL & GREASE - HEM	1.2	UJ	D	MS/MSD recovery non-compliance
S23GWMPM-03	PHENANTHRENE	0.98	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	PHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM-03	PYRENE	0.84	J	DG	MS/MSD recovery non-compliance and field duplicate imprecision.
S23GWMPM-03	TETRACHLOROETHENE	0.3	J	Р	Uncertainty near the detection limit.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 6 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION		
S23GWMPM-03	TOTAL PETROLEUM HYDROCARBONS	160	U	A	Laboratory blank contamination.		
S23GWMPM-03	TRICHLOROETHENE	0.4	J	Р	Uncertainty near the detection limit.		
S23GWMPM-03	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.		
S23GWMPM-03	VANADIUM	0.34	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	1,1,2-TRICHLOROETHANE	0.5	UJ	R	Surrogate recovery non-compliance.		
S23GWMPM-03-D	1-METHYLNAPHTHALENE	0.048	J	Р	Uncertainty near the detection limit.		
S23GWMPM-03-D	2,4-DINITROPHENOL	25	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	2-METHYLNAPHTHALENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	3,3'-DICHLOROBENZIDINE	10	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	3-NITROANILINE	25	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	4,6-DINITRO-2-METHYLPHENOL	25	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	4-NITROPHENOL	25	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	ACENAPHTHENE	0.029	J	GP	Field duplicate imprecision and uncertainty near the detection limit.		
S23GWMPM-03-D	ACENAPHTHYLENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	ANTHRACENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	ANTIMONY	1.1	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	ANTIMONY	1.3	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	ARSENIC	4.7	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	ARSENIC	1.1	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	BENZO(A)ANTHRACENE	0.042	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	BENZO(B)FLUORANTHENE	0.078	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	CHRYSENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	CIS-1,3-DICHLOROPROPENE	0.5	UJ	R	Surrogate recovery non-compliance.		
S23GWMPM-03-D	COPPER	0.68	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	ETHYLBENZENE	0.5	UJ	R	Surrogate recovery non-compliance.		
S23GWMPM-03-D	FLUORANTHENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	FLUORENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	HEXACHLOROBENZENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	HEXACHLOROCYCLOPENTADIENE	10	UJ	С	Calibration non-compliance.		
S23GWMPM-03-D	ISOPROPYLBENZENE	0.5	UJ	R	Surrogate recovery non-compliance.		
S23GWMPM-03-D	LEAD	2.2	U	A	Laboratory blank contamination.		
S23GWMPM-03-D	LEAD	2.8	U	А	Laboratory blank contamination.		
S23GWMPM-03-D	NAPHTHALENE	0.088	J	GP	Field duplicate imprecision and uncertainty near the detection limit.		
S23GWMPM-03-D	PHENANTHRENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	PYRENE	0.2	UJ	G	Field duplicate imprecision.		
S23GWMPM-03-D	SELENIUM	2.3	U	A	Laboratory blank contamination.		

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 7 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (μG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM-03-D	STYRENE	0.5	UJ	R	Surrogate recovery non-compliance.
S23GWMPM-03-D	TETRACHLOROETHENE	0.2	J	PR	Uncertainty near the detection limit and surrogate recovery non-compliance.
S23GWMPM-03-D	TOLUENE	0.5	UJ	R	Surrogate recovery non-compliance.
S23GWMPM-03-D	TOTAL PETROLEUM HYDROCARBONS	1600	J	G	Field duplicate imprecision.
S23GWMPM-03-D	TOTAL XYLENES	0.5	UJ	R	Surrogate recovery non-compliance.
S23GWMPM-03-D	TRANS-1,3-DICHLOROPROPENE	0.5	UJ	R	Surrogate recovery non-compliance.
S23GWMPM-03-D	TRICHLOROETHENE	0.3	J	PR	Uncertainty near the detection limit and surrogate recovery non-compliance.
S23GWMPM-03-D	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.
S23GWMPM04	1-METHYLNAPHTHALENE	0.093	J	Р	Uncertainty near the detection limit.
S23GWMPM04	2,2'-OXYBIS(1-CHLOROPROPANE)	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2,4,5-TRICHLOROPHENOL	26	UJ	Н	Holding time exceedance.
S23GWMPM04	2,4,6-TRICHLOROPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM04	2,4-DICHLOROPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM04	2,4-DIMETHYLPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM04	2,4-DINITROPHENOL	26	UJ	Н	Holding time exceedance.
S23GWMPM04	2,4-DINITROTOLUENE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2,6-DINITROTOLUENE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2-CHLORONAPHTHALENE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2-CHLOROPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2-METHYLNAPHTHALENE	0.21	UJ	С	Calibration non-compliance.
S23GWMPM04	2-METHYLNAPHTHALENE	0.2	UJ	С	Calibration non-compliance.
S23GWMPM04	2-METHYLPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM04	2-NITROANILINE	26	UJ	Н	Holding time exceedance.
S23GWMPM04	2-NITROPHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM04	3&4-METHYLPHENOL	10	UJ	DH	MS/MSD recovery non-compliance and holding time exceedance.
S23GWMPM04	3,3'-DICHLOROBENZIDINE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	3-NITROANILINE	26	UJ	H	Holding time exceedance.
S23GWMPM04	4,6-DINITRO-2-METHYLPHENOL	26	UJ	H	Holding time exceedance.
S23GWMPM04	4-BROMOPHENYL PHENYL ETHER	10	UJ	Н	Holding time exceedance.
S23GWMPM04	4-CHLORO-3-METHYLPHENOL	10	UJ	H	Holding time exceedance.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 8 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (μG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
S23GWMPM04	4-CHLOROANILINE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	4-CHLOROPHENYL PHENYL ETHER	10	UJ	Н	Holding time exceedance.
S23GWMPM04	4-NITROANILINE	1	UJ	С	Calibration non-compliance.
S23GWMPM04	4-NITROANILINE	1	UJ	С	Calibration non-compliance.
S23GWMPM04	4-NITROPHENOL	26	UJ	Н	Holding time exceedance.
S23GWMPM04	ACENAPHTHENE	0.031	J	Р	Uncertainty near the detection limit.
S23GWMPM04	BENZENE	0.2	J	Р	Uncertainty near the detection limit.
S23GWMPM04	BENZO(G,H,I)PERYLENE	0.13	J	Р	Uncertainty near the detection limit.
S23GWMPM04	BIS(2-CHLOROETHOXY)METHANE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	BIS(2-CHLOROETHYL)ETHER	10	UJ	Н	Holding time exceedance.
S23GWMPM04	BIS(2-ETHYLHEXYL)PHTHALATE	1	UJ	С	Calibration non-compliance.
S23GWMPM04	BIS(2-ETHYLHEXYL)PHTHALATE	1	UJ	С	Calibration non-compliance.
S23GWMPM04	BUTYL BENZYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	CARBAZOLE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	CIS-1,2-DICHLOROETHENE	0.2	J	Р	Uncertainty near the detection limit.
S23GWMPM04	DIBENZOFURAN	10	UJ	Н	Holding time exceedance.
S23GWMPM04	DIETHYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	DIMETHYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	DI-N-BUTYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	DI-N-OCTYL PHTHALATE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	FLUORENE	0.21	UJ	С	Calibration non-compliance.
S23GWMPM04	FLUORENE	0.2	UJ	С	Calibration non-compliance.
S23GWMPM04	HEXACHLOROCYCLOPENTADIENE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	HEXACHLOROETHANE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	INDENO(1,2,3-CD)PYRENE	0.22	J	С	Calibration non-compliance.
S23GWMPM04	INDENO(1,2,3-CD)PYRENE	0.21	UJ	С	Calibration non-compliance.
S23GWMPM04	ISOPHORONE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	NAPHTHALENE	0.069	J	Р	Uncertainty near the detection limit.
S23GWMPM04	NITROBENZENE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	N-NITROSO-DI-N-PROPYLAMINE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	N-NITROSODIPHENYLAMINE	10	UJ	Н	Holding time exceedance.
S23GWMPM04	PENTACHLOROPHENOL	1	UJ	CR	Calibration non-compliance and surrogate recovery non-compliance.
S23GWMPM04	PHENOL	10	UJ	Н	Holding time exceedance.
S23GWMPM04	TETRACHLOROETHENE	0.3	J	P	Uncertainty near the detection limit.
S23GWMPM04	TRICHLOROETHENE	0.4	J	Р	Uncertainty near the detection limit.
TB061807	CHLOROETHANE	0.5	ÜJ	C	Calibration non-compliance.
TB061807	METHYLENE CHLORIDE	0.6	J	C	Calibration non-compliance.

TABLE 3-2

DATA QUALIFICATION AND REASONS FOR QUALIFICATIONS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 9 OF 9

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (µG/L)	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
TB061807	TOLUENE	0.2	J	Р	Uncertainty near the detection limit.
TB061807	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.
TB121807-01	TRICHLOROFLUOROMETHANE	0.5	UJ	С	Calibration non-compliance.

MS/MSD = Matrix spike/matrix spike duplicate

TABLE 3-3

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 3

PARAMETER	Surface Water Protection Criteria ⁽¹⁾	Residential Volatilization Criteria ⁽²⁾	Stormwater Discharge Permit Criteria ⁽³⁾	ROU JUNE 1	ND 1 8, 2006	ROUND 2 SEPTEMBER 6, 2007	ROU! DECEMBE		ROUND 4 FEBRUARY 21, 2008
		omona	1 omit omona	Sample	Duplicate	Sample	Sample	Duplicate	Sample
Volatile Organics (μg/L)									
BENZENE	710	130	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J
BROMODICHLOROMETHANE	2.3	NE	NA	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	14100	26	NA	3 J	2 J	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	NE	NE	NA	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHENE	NE	830	NA	0.3 J	0.2 J	0.3 J	0.2 J	0.5 U	0.2 J
ISOPROPYLBENZENE	NE	2800	NA	0.1 J	0.09 J	0.1 J	0.5 U	0.5 UJ	0.5 U
METHYL TERT-BUTYL ETHER	NE	21000	NA	1	0.9	0.4 J	0.6	0.6	0.7
TETRACHLOROETHENE	88	340	NA	0.3 J	0.3 J	0.4 J	0.3 J	0.2 J	0.3 J
TRICHLOROETHENE	2340	27	NA	0.4 J	0.3 J	0.5 J	0.4 J	0.3 J	0.4 J
PAHs (μg/L)						1		•	
1-METHYLNAPHTHALENE	NE	NE	NA	0.2 U	0.2 U	0.2 U	0.96 J	0.048 J	0.21 U
2-METHYLNAPHTHALENE	NE	NE	NA	0.17 J	0.16 J	0.2 U	1.1 J	0.2 UJ	0.21 UJ
4-NITROANILINE	NE	NE	NA	0.2 U	0.2 U	1 UJ	0.75 J	1.0 UR	1.0 UJ
ACENAPHTHENE	NE	NE	NA	0.2 U	0.2 U	0.2 U	0.83 J	0.029 J	0.21 U
ACENAPHTHYLENE	0.3	NE	NA	0.2 U	0.2 U	0.2 U	0.90 J	0.20 UJ	0.21 U
ANTHRACENE	1,100,000	NE	NA	0.2 U	0.2 U	0.2 U	0.92 J	0.20 UJ	0.21 U
BENZO(A)ANTHRACENE	0.3	NE	NA	0.07 U	0.07 U	0.041 U	1.0 J	0.042 UJ	0.045 U
BENZO(A)PYRENE	0.3	NE	NA	0.2 UJ	0.2 U	0.2 U	0.35 J	0.20 U	0.21 U
BENZO(B)FLUORANTHENE	0.3	NE	NA	0.08 U	0.08 U	0.075 U	0.64 J	0.078 UJ	0.082 U
BENZO(G,H,I)PERYLENE	NE	NE	NA	0.2 UJ	0.2 U	0.2 U	0.31	0.20 U	0.21 U
BENZO(K)FLUORANTHENE	0.3	NE	NA	0.2 UJ	0.2 UJ	0.2 U	0.53 J	0.20 U	0.21 U
CHRYSENE	NE	NE	NA	0.2 U	0.2 U	0.2 U	0.76 J	0.20 UJ	0.21 U
DIBENZO(A,H)ANTHRACENE	NE	NE	NA	0.2 UJ	0.2 U	0.2 U	0.14 J	0.20 U	0.21 U
FLUORANTHENE	3,700	NE	NA	0.2 U	0.2 U	0.2 U	1.1 J	0.20 UJ	0.21 U
FLUORENE	140,000	NE	NA	0.2 U	0.2 U	0.2 U	0.97 J	0.20 UJ	0.21 UJ
HEXACHLOROBENZENE	0.077	NE	NA	1 U	1 U	0.2 U	1.2 J	0.20 UJ	0.21 U
HEXACHLOROBUTADIENE	NE	NE	NA	0.2 U	0.2 U	0.48 U	0.64 J	0.099 U	0.21 U
INDENO(1,2,3-CD)PYRENE	NE	NE	NA	0.2 UJ	0.2 U	0.2 U	0.22	0.20 U	0.21 UJ
NAPHTHALENE	NE	NE	NA	0.2 U	0.2 U	0.2 U	1.0 J	0.088 J	0.21 U
PHENANTHRENE	0.3	NE	NA	0.2 U	0.2 U	0.2 U	0.98 J	0.20 UJ	0.21 U
PYRENE	110,000	NE	NA	0.2 U	0.2 U	0.2 U	0.84 J	0.20 UJ	0.21 U
PAHs, Filtered (μg/L)	i ' '			5. L 0	1 3.2 3	J U		1	L
1-METHYLNAPHTHALENE	NE	NE	NA	NA	NA	NA	NA	NA	0.093 J
2-METHYLNAPHTHALENE	NE	NE	NA	NA	NA	NA	NA	NA	0.2 UJ
4-NITROANILINE	NE	NE	NA	NA	NA	NA	NA	NA	1.0 UJ
ACENAPHTHENE	NE	NE	NA	NA	NA	NA	NA	NA	0.031 J
ACENAPHTHYLENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.2 U

TABLE 3-3

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

PARAMETER	Surface Water Protection Criteria ⁽¹⁾	Residential Volatilization Criteria ⁽²⁾	Stormwater Discharge Permit Criteria ⁽³⁾		IND 1 18, 2006	ROUND 2 SEPTEMBER 6, 2007	ROUI DECEMBE		ROUND 4 FEBRUARY 21, 2008
				Sample	Duplicate	Sample	Sample	Duplicate	Sample
PAHs, Filtered (continued) (μg/L)									
ANTHRACENE	1,100,000	NE	NA	NA	NA	NA	NA	NA	0.2 U
BENZO(A)ANTHRACENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.042 U
BENZO(A)PYRENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.2 U
BENZO(B)FLUORANTHENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.078 U
BENZO(G,H,I)PERYLENE	NE	NE	NA	NA	NA	NA	NA	NA	0.13 J
BENZO(K)FLUORANTHENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.2 U
CHRYSENE	NE	NE	NA	NA	NA	NA	NA	NA	0.2 U
DIBENZO(A,H)ANTHRACENE	NE	NE	NA	NA	NA	NA	NA	NA	0.2 U
FLUORANTHENE	3,700	NE	NA	NA	NA	NA	NA	NA	0.2 U
FLUORENE	140,000	NE	NA	NA	NA	NA	NA	NA	0.2 UJ
HEXACHLOROBENZENE	0.077	NE	NA	NA	NA	NA	NA	NA	0.2 U
HEXACHLOROBUTADIENE	NE	NE	NA	NA	NA	NA	NA	NA	0.2 U
INDENO(1,2,3-CD)PYRENE	NE	NE	NA	NA	NA	NA	NA	NA	0.22 J
NAPHTHALENE	NE	NE	NA	NA	NA	NA	NA	NA	0.069 J
PHENANTHRENE	0.3	NE	NA	NA	NA	NA	NA	NA	0.2 U
PYRENE	110,000	NE	NA	NA	NA	NA	NA	NA	0.2 U
Inorganics, Total (μg/L)									<u> </u>
ALUMINUM	NE	NA	NA	473	115	322	38.1	21.8	29.4
ARSENIC	4	NA	NA	3.7 U	3 U	13.9	2.2 U	4.7 U	3.1
BARIUM	NE	NA	NA	48.2	52.4	87	55.2	53.4	55.9
CALCIUM	NUT	NA	NA	33800	35800	32000	35,500	34,700	34,300
CHROMIUM	110 (4)	NA	NA	0.94 U	0.81 U	2	0.41	0.28 U	0.38 U
COBALT	NE	NA	NA	0.84 U	0.64 U	0.26 U	0.66	0.53	0.6
COPPER	48	NA	60	3 U	3 U	4.2	0.44 U	0.22 U	0.8 U
IRON	NUT	NA	NA	9,190	11,900	70,800	9,860	10,200	4,380
LEAD	13	NA	30	2.2	9.3	8.4	2.5 U	2.2 U	1.4 U
MAGNESIUM	NUT	NA	NA	7,260	7660	7,020	7,660	7,490	7,450
MANGANESE	NE	NA	NA	661	715	845	858	815	784
NICKEL	880	NA	NA	1.1 U	0.88 U	0.41 U	0.53	0.46	0.64
POTASSIUM	NUT	NA	NA	5210	5490	5,270	5,590	5,490	5,150
SELENIUM	50	NA	NA	1.5 U	2 J	1.5 U	1.5 U	1.5 U	2.2 U
SILVER	12	NA	NA	0.46 U	0.46 U	1.5	0.46 U	0.46 U	0.54 U
SODIUM	NUT	NA	NA	46,900	49,600	52,100	53,400	52,300	50,100
VANADIUM	NE	NA	NA	1.3 U	1.4 U	3.7	0.34 U	0.29 U	0.52 U
ZINC	123	NA	200	21.3 J	22.3	47.1	22.8	20.0	26.6

TABLE 3-3

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT **NSB-NLON, GROTON, CONNECTICUT** PAGE 3 OF 3

PARAMETER	Surface Water Protection Criteria ⁽¹⁾	Residential Volatilization Criteria ⁽²⁾	Stormwater Discharge Permit Criteria ⁽³⁾	ROUI JUNE 18		ROUND 2 SEPTEMBER 6, 2007	ROU DECEMBE		ROUND 4 FEBRUARY 21, 2008
		Onteria	T erinit Criteria	Sample	Duplicate	Sample	Sample	Duplicate	Sample
Inorganics, Filtered (μg/L)									
ALUMINUM	NE	NA	NA	20.4 J	36.7 J	21.3 J	19.0 U	19.0 U	35.4
ARSENIC	4	NA	NA	3.5 U	2.2 U	1.2 J	1.9 U	1.1 U	2.8
BARIUM	NE	NA	NA	44.6	46.4	50.1	48.9	49.6	56.8
CALCIUM	NUT	NA	NA	33,600	34,700	31,400	33,100	33,400	36,000
CHROMIUM	110 (4)	NA	NA	1.2 U	0.44 U	0.3 J	0.29	0.48	0.38 U
COBALT	NE	NA	NA	0.67 U	0.86 U	0.47 J	0.48	0.51	0.64
IRON	NUT	NA	NA	3,470	3,630	3,600	4,190	4,140	3,750
LEAD	13	NA	30	1.3 J	1.8 J	1.1 U	2.1 U	2.8 U	1.4 U
MAGNESIUM	NUT	NA	NA	7,200	7,480	6,980	7,250	7,300	8,020
MANGANESE	NE	NA	NA	645	664	708	764	770	815
NICKEL	880	NA	NA	1.1 U	0.88 U	0.78 J	1.0	0.64	0.66
POTASSIUM	NUT	NA	NA	5,090	5,390	5,320	5,360	5,390	5,390
SELENIUM	50	NA	NA	1.5 U	1.7 J	2.4 U	1.5 U	2.3 U	2.2 U
SODIUM	NUT	NA	NA	46,600	48,400	52,600	50,400	51,400	52,100
ZINC	123	NA	200	21.4 J	19.5 J	15	18.6	20.8	26
Petroleum Hydrocarbons (μg/L)			•						
ETPH (C09-C36)	NE	NE	2500 ⁽⁵⁾	55 J	79 U	140 J	160 U	1600 J	75 U
Petroleum Hydrocarbons, Filtered (μg/L)									
ETPH (C09-C36)	NE	NE	2500 ⁽⁵⁾	NA	NA	NA	NA	NA	75 U

- Connecticut Remediation Standard Regulations (January 1996) and Comprehensive List of Approved Additional Polluting Substances Criteria and Alternative Criteria (October 2005). Proposed Revisions to Connecticut's Remediation Standard Regulations, Volatilization Criteria (March 2003).

 NSB-NLON General Permit for the Discharge of Stormwater Associated with Industrial Activity (DEP-PERD-GP-014, Issuance Date: October 1, 2002 and Modified Date: July 15, 2003).
- Criterion is for hexavalent chromium
- Criterion is for oil and grease.
- Sample results that exceed a criterion are shown in bold font. Not applicable. BOLD
- NE Not established.
- NUT Essential nutrient.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

This Year 1 Annual Groundwater Monitoring Report summarizes groundwater data collected from the underdrain metering pit at Site 23 during Rounds 1 through 4. The results are used to determine the quality of groundwater being collected and conveyed by the underdrain piping and whether constituent levels in the water pose potential risks to human health or the environment.

The Site 23 underdrain metering pit was sampled in June, September, and December 2007, and February 2008, and samples were analyzed for TCL VOCs, TCL SVOCs, TCL PAHs, TAL metals (total or dissolved), oil and grease, and ETPH. Conclusions based on evaluation of the results of these sampling events are as follows:

- All four rounds of data were similar and in general all concentrations were established Connecticut
 criteria with the exception of arsenic in Round 2 and seven PAHs (acenaphthylene,
 benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k) flouranthene,
 hexachlorobenzene, and phenanthrene) in Round 3.
- No contaminants were detected at concentrations greater than any established Connecticut criteria during Rounds 1 and 4.
- Arsenic was detected at a concentration greater than the Surface Water Protection Criterion in an
 unfiltered sample during the Round 2 sampling event. However, arsenic was not detected in the
 filtered sample at a concentration that exceeded the criterion. Therefore, the filtered result, which is
 more indicative of groundwater quality, does not indicate that arsenic in groundwater presents a
 significant threat to human health and the environment.
- It is thought that the PAH detections in the Round 3 are related to sediment particles being present in
 the groundwater sample because no PAH detections concentration exceeded the criteria in the field
 duplicate or in the Round 4 sample, which was collected using a new sampling technique. Therefore,
 the PAH results in the original Round 3 sample from do not appear indicative of groundwater quality.
- Site 23 groundwater being collected and conveyed in the storm sewer system does not pose a significant current threat to human health or the environment by comparison of results to CTDEP criteria.

• Based on the Human Health Risk Assessment, under current and expected land use, Site 23 groundwater does not pose a significant threat to human health from direct exposure by construction workers or vapor intrusion into buildings. Adverse health effects are possible under hypothetical residential land use if the groundwater is used as a potable source.

4.2 RECOMMENDATIONS

The following recommendation are made for Site 23 groundwater:

- Based on the analytical results from Rounds 1 through 4 and the human health risk evaluation, implementation of institutional controls are required at Site 23 to identify the location and magnitude of groundwater contamination and to restrict extraction and use of the groundwater for residential purposes. These controls should be implemented as part of the remedies for OU 9.
- Additional monitoring is not required at Site 23 because there are no long-term monitoring requirements; however, collecting of additional rounds of data may clarify some of the anomalous results identified during Year 1.
- If additional monitoring is conducted, the analytical program should remain the same and the Round 4 sampling technique should be used to minimize impacts of suspended solids on sample results.

REFERENCES

Foster Wheeler Environmental Corporation (FWEC), 2001. Final Closeout Report for Storm Sewer Rehabilitation, Naval Submarine Base New London, Groton, Connecticut. May.

Tetra Tech, 2002. Basewide Groundwater Operable Unit Remedial Investigation Report, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania.

Tetra Tech NUS, Inc.(Tetra Tech), 2006. Second Five-year Review Report for CERCLA Sites at Naval Submarine Base new London, Groton, Connecticut. King of Prussia, Pennsylvania. December.

Tetra Tech, 2007a. Work Plan for Site 23 Underdrain Metering Pit Sampling, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania. April.

Tetra Tech, 2007b. Letter Report for June 2007 Sampling Event, Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania. August.

Tetra Tech, 2007c. Letter Report for September 2007 Sampling Event, Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania. October.

Tetra Tech, 2008. Letter Report for December 2007 Sampling Event, Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania. February.

Tetra Tech, 2008a. Human Health Risk Assessment Memo - Site 23 Groundwater, Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut, May 19.

Tetra Tech, 2008b. Memorandum Regarding Vapor Intrusion Evaluation for Groundwater at Operable Unit 9, Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut. May 30.

USEPA, 1989 - U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses. February.

USEPA, 1996 - U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses. December.

USEPA, 2001 - U.S. EPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review. June.

USEPA, 2008. EPA Comments on the Basewide Groundwater Vapor Intrusion Analyses. Email from Kymberlee Kecker of USEPA Region I to Corey Rich of Tetra Tech NUS, Inc. April 24.



APPENDIX A

FIELD FORMS

APPENDIX A.1

ROUND 1 - FIELD FORMS

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EQUIPMENT CALIBRATION LOG

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PROJECT No.:	112G00777	SERIAL NUMBER: 3594	- 350 <i>2</i>

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SURFACE WATER SAMPLE LOG SHEET

Page of Project Site Name: **NSB NEW LONDON** Sample ID No .: S23GWMPM01 Project No.: 112GN00777 Sample Location: Site 23 Sampled By: T. Rojahn Stream C.O.C. No.: 4779 [] Spring □ Pond Type of Sample: Lake [X] Low Concentration [X] Other: Manhole - monitoring Pit | High Concentration [] QA Sample Type: TO STANDED METERS OF THE STANDARD OF THE STAND Date: 6/18/2007 Color рH S.C. Temp. **Turbidity** DO Salinity Other Time: 9:30 Visual Standard mS/cm Degrees C NTU mg/l NA Depth: NA 6.18 0.709 16.63 55.6 9.00 NA NA Method: precip. S.S. Beaker Samere en le la comparte de la compa Preservative **Container Requirements** Collected Volatiles 4ºC/HCI (3) 40 ml VOA Vial Yes TCL SVOCS, PAHS & SIM 4ºC (2) 1 L Glass Amber Yes Total Oil and Grease 4ºC/H₂SO₄ (2) 1 L Glass Amber Yes ETPH 4ºC (2) 1 L Glass Amber Yes Total TAL Metals 4ºC/HNO₃ (1) 500 ml HDPE Yes Dissolved TAL Metals 4ºC/HNO₃ (1) 500 ml HDPE Yes SEIKOVANKSVAOTASEED Circle if Applicable: Signature(s): Twylgoh MS/MSD **Duplicate ID No.:** YES FD-061807

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APPENDIX A.2

ROUND 2 - FIELD FORMS

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PROJ	ECT NO:	777	FACILITY:	NSB	aN	PROJ	ECT MA	NAGE!	₹	PH	IONE NI	JMBER	9984	•	LABOR	ATORY	NAME	AND CO	NTACT:	
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DATE 2007	TIME	S/	AMPLE ID		LOCATION ID	тор вертн (FT)	ВОТТОМ DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G)	No. OF CONTAINERS	THE	OF AVAIL	SIR SIR SIR SIR SIR SIR SIR SIR SIR SIR	2000	360	SE AND	AND AND AND AND AND AND AND AND AND AND	1. 6. 8. S.		NIMENTS
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Project Site Name:		NGR NEV	/ I ONDO		Čamul-	ID No		
Project No.:			V LONDON	N	-	ID No.:		VMPM02
		1120	00777		•	Location:		te 23
[] Stream					Sample	•		Rojahn
[] Spring	•				C.O.C.	NO.:	425	<u> </u>
[] Pond					-			
[] Lake				•		Sample:		e e e e e e e e e e e e e e e e e e e
[X] Other:		look-l- *	Annie -	Dia		w Concent		•
[] QA Sample Type:		Manhole - M	nonitoring	Pit	. U Higr	Concentra	ation	,
g GA Campie Type.		·	· · · · · · · · · · · · · · · · · · ·					
STANDSTELLES EXECUTES								
Date: 9-6-07	Color	рΗ	S.C.	Temp.	Turbidity	DO	Salinity	Other .
Time: /325	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Other ORP MV
Depth: NA	CLEAR W/ ORANGE	6.61	5.8	177	21	4.7		
Method: S.S. Beaker	PERCIP.			17.3	26	7. /	0.0	15
SAMPLE (COLLECTED MINIS	an Employed							termen i montre aktivit sustanti.
Analysis Volatiles		Preserv			Container R			Collected
Volatiles TCL SVOCS, PAHS & SIM		4°C/	/HCI	3 ×	(3) 40 ml		<u> </u>	Yes
Total Oil and Grease			U I₂SO₄	3 × 3 ×	(2) 1 L Gla		·	Yes
ЕТРН		40		3 ×	(2) 1 L Gla			Yes Yes
Total TAL Metals		4ºC/l		ZX	(1) 500 n			Yes
Dissolved TAL Metals		4ºC/F	1NO ₃	2 ×	(1) 500 n			Yes
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EQUIPMENT CALIBRATION LOG

PROJI	ECT NAME:	NSB NEW L	ONDON	-	INSTRUME	NT NAME/MC	DDEL:	LAMOTTE 2020
SITE	NAME:	23	· · · · · · · · · · · · · · · · · · ·	<u>.</u>	MANUFACT	URER:	· .	LAMOTTE
PROJ	ECT No.:	112G00	777	<u>-</u>	SERIAL NUI	MBER:		39-0501
Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Filet*	ITUs Fost calleialon	10 l Pre ealle Pulen	NUTs Post Gellbietieni	Calibration Standard (Lot No.)	Remarks and Comments
9-6-07	SAME	7× •	0.00	0.00	9.83	10.00	0 =	NA BNP 7/1/08 GFS # 8184-P780246
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DOCUMENTATION OF FIELD CALIBRATION

PROJECT NAME:	NSB NEW LONDON	INSTRUMENT NAME/MODEL:	U-22
SITE NAME:	23	MANUFACTURER:	Horiba
PROJECT No.:	112G00777	SERIAL NUMBER:	1100520X

Date	Person		INITIA	L READ	INGS				FIN/	L READI	NGS	ĺ.	I	Calibration	Remarks
of Calibration	Performing Calibration	PH ≲ <i>U</i> .	COND ms/cm	TURB NTU		TEMP	SAL	PH	COND	TURB	DO	TEMP	SAL	Standard (Lot No.)	and Comments
9/6/07	T.R.	4.79	460	l	9.3	21.9	WA	4.00	4,50		8.90	21.9	NΑ	5585	Exp 2-1-08
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APPENDIX A.3

ROUND 3 – FIELD FORMS

BOOK NO. 1398 THES 12.18.07 SITE 23 Work continued from Page WEATHEN SUNNY KEUTH SIMPSON 12.17.07 PM TRAVEL TO GROTON CT & LanoTTE 0635 CAL HUNBA PASS Z TO 10 0655 MEET DICK CONANT SIGN IN /PICK-UP PASS TO MAN HOLE OF SITE 23 CLEAN FROM MAN HOLE AREA TRANSPORT BOTTLES Z TO MH & EQ. STANT 0810 SAMPLING (SEE PS 122) COMPLETE 1100 SAMPUN9 CLEAN-4P & CLOSE TO EXUNDRATENTAL & LET DICK KNOW 10 Sampling COMPLETE TO 2 LMW 36B + ABANDON MW-ANEA SKOU coverien could not the til JOB PATCH TO GAS STATION & PUCIL-UP ICE TO 1130 HOTEL PACK SAMPLES & EQ. LUNCH & CHECK OUT 15 70 1330 OF HOTEL FEN EX AB # 8631 2568 3070 6-AS 1440 RENTAL CAR TO TE GUEEN AINPOUT WORK PAPEN P9H1 20 25 30 35 SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA Work continued to Page **SIGNATURE** DATE 12.19.07 DATE WITNESS

12-18-07

REMIN SIMPSON

SAMPIED SD3G-WMPM-03 @, 0840

+ COUNECTED DUP & MS/MSD

PH S.67 S.C. O. S94 HEMP 13.2

THURS 3. 4 DO 4.15 SAC 76 O

ORP +52

EST. FLOW RATE 6 GPM

NUMBER

PROJECT NO: FACILITY: CTO 73 1126-00777 NSB-NCON	PROJE	CT MA	NAGER		PH 41	ONE NU	JMBER	984		ABOR	ATORY AH AL	NAME /	AND CO	NTACT:	
SAMPLERS (SIGNATURE)	FIELD	OPERA	TIONS	LEADER	PH				. 7	ADDRE	SS	<u> </u>			
7/7/5/2	KEI	TH	SIM	PSUX NUMBER	41	2 92	11 8	<u> 131 </u>		60	0 1	ECHI	1010	by w	AY
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	fel) EX	06	3/	<u> </u>		AINER			SCAI				E 040	74
CTANDARD TAT SV						PLAS	TIC (P)	or GLA	SS (G)	\angle		8/	· /	5/2/	V ///
STANDARD TAT ☑ RUSH TAT ☐ □ 24 hr. □ 48 hr. □ 72 hr. □ 7 day □ 14 day			, oc,			PRES USED	ERVAT	IVE		\ <u>`</u> `	K.	×.0/	/5	NA KEN	
VEAR LOOY WELEN DLL BONN D COCATION ID COCATION ID	тор рертн (ғт)	ВОТТОМ DEPTH (FT)	MATRIX (GW, SO, SW, SD, ETC.)	COLLECTION METHOD GRAB (G)	No. OF CONTAINERS	THE	OF AMALY	\$\$ 150 th	Kride Control of the	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	15 15 15 15 15 15 15 15 15 15 15 15 15 1	2000	(, 0 / x) (x) (x)	co	MMENTS
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12/10 0840 5236WMPM-03 MAN HOLE			GW	1	31	9	6	6	6	2	2		·	RUN /	ACSO
12/18 0000 FD 121807-0/			J		11	3	2	2	2	1	1			(4, 3)	- 30
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COMMENTS	1							•					<u>-1</u>	· .	



SURFACE WATER SAMPLE LOG SHEET

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Project Site Name:	• •	NSB NFV	W LONDO	N	Sample	e ID No.:	00001	4/1.4D1.400
Project No.:			300777		-	Location:		VMPM03
		- 1120	200777	· · · · · · · · · · · · · · · · · · ·	_ Sample			le 23
[] Stream		·			C.O.C.		K. Si	mpson
[] Spring	Rour	10 3	3		0.0.0.	INU		
[] Pond				• • •	Type of	Sample:	•	
[] Lake	• *					w Concent	ration	
[X] Other:	1	Vanhole - N	Monitorina	Pit		h Concentr		•
[] QA Sample Type:			<u></u> .g			ii Ooneenii	auon	
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Date: 12.18.07	the state of the second of the				(<u></u>			
Time: 0840	Color	pH	s.c.	Temp.	Turbidity	DO	Salinity	8ther p
Depth: NA	Visual	Standard		Degrees C	NTU	mg/l	%	NA
Method: S.S. Beaker	COUPY	5.67	0.544	13.2	3.4	4.15	0	+52
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Analysis		Preser	vative	a tina na sana tanbilatan basang a di " Basang a sana tanbilatan basang a di "		equirements		Collected
Volatiles			/HCI	9-	4	VOA Vial		Yes
TCL SVOCS, PAHS & SIM		4 ⁰	,c	6+		ass Amber		Yes
Total Oil and Grease			I₂SO₄	' 6-1	^L (2) 1 L Gla	ass Amber		Yes
ETPH Total TAL Metals			,c		ا (2) 1 L Gla	ass Amber		Yes
Dissolved TAL Metals			-INO ₃	2 -				Yes
DISCOTTOR TAL METAIS	· · · · · · · · · · · · · · · · · · ·	4 C/I	-INO ₃	2+	(1) 500 r	nl HDPE		Yes
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EQUIPMENT CALIBRATION LOG

	PROJECT N	NAME: .	NSB NEW L		<u> </u>	INSTRUME	NT NAME/MO	DEL:		AMOTTE 202	20 E
Date of I.D. Performing Person ONTUS 10 NUTS Calibration Standard (Lot No.) Calibration Number Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Calibration Comments	SITE NAME:	= : .	23	ROUM) <u>3</u>	MANUFACT	URER:			LAMOTTE	
of I.D. Performing Post Post Pres Standard and Calibration Calibra	PROJECT N	No.:	112G00	777	_	SERIAL NUI	MBER:	SN - 1	4E 12	179	
	of I	I.D.	Performing Calibration	SauPress	Post	1976	1970	Standard		and	
	12.18.07 123	279	K' ZIWBZAK	0.0	0.0	10.0		0= P7 10 = P6	81115 77870		9/2008 8/2008

RENTED FROM
EAGLE INSTRUMENTS
PO# 1027271

Tetra Tech NUS, Inc.	Tetra Tech NUS,	Inc.
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DOCUMENTATION OF FIELD CALIBRATION

PROJECT NAME	: NSB NEW LONDON	INSTRUMENT NAME/MODEL:	U-22
SITE NAME:	23 ROUND 3	MANUFACTURER:	Horiba
PROJECT No.:	112G00777	SERIAL NUMBER:	701025

Date	Person		INITIA	L READ	INGS	<u> </u>			FINA	AL READI	NGS	1	<u> </u>	Calibration	Remarks
	Performing Calibration	PH 54	COND MS/CM	TURB	DO	TEMP OC	SAL 70	PH	COND		DO	TEMP	SAL	Standard (Lot No.)	and Comments
12.18.07	K. SIMPSON	3,99	4.30	0	7.73	25.4	0.2	4.00	4.49	0	7.70	25.4	0.1	5741	EXP 5/2008
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APPENDIX A.4

ROUND 4 - FIELD FORMS

ROUND 4 SITE 23 PROJECT NO. //2G00777

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BOOK NO. 1398 WED 2-20-08 Work continued from Page PIT AIRPORT 1100 HRS ARRIVE @ DAUISVILLE 1400 HES - ARRIVE TRAILEX Buckets liell etc sampling 60. PACKAGE FOR PAUISUILLE SHIR TO OFFICE PACICAGE 3 PACKAGES + FED EX AB CA GROTON HOTEL ARRIVE @ PAPERWORK 1910 HRS 15 20 25 30 35 Work continued to Page SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA SIGNATURE 2-20-08 DISCLOSED TO AND UNDERSTOOD BY DATE DATE WITNESS

DATE

WITNESS

DISCLOSED TO AND UNDERSTOOD BY

TŁ	Tetra Tech NUS, I	Inc.
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DOCUMENTATION OF FIELD CALIBRATION

PROJECT NAME :	NSB NEW LONDON	INSTRUMENT NAME/MODEL:	U-22		
SITE NAME:	23	MANUFACTURER:	Horiba	_	
PROJECT No.:	112G00777	SERIAL NUMBER:	3073010		

Date	Person		INITI	AL READ	INGS				FIN	AL READI	NGS		l	Calibration	Remarks
of Calibration	Performing Calibration	PH	COND	TURB	DO	TEMP	SAL	PH	COND	TURB	DO	TEMP	SAL	Standard (Lot No.)	and Comments
2/21	TR	4.00	4.48		10.53	20.23		400	448	0,0	9.01	20.24		5843	Exp 7/31/08
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EQUIPMENT CALIBRATION LOG

PROJECT NAME :	NSB NEW LONDON	INSTRUMENT NAME/MODEL:	LAMOTTE 2020	
SITE NAME:	23	MANUFACTURER:	LAMOTTE	•
PROJECT No	112000777	SERIAL NUMBER	5915 - 2445	

		112007		• •	OLI IIAL IVOI			
Date	Instrument	Person	0 N			lUTs	Calibration	Remarks
of Calibration	I.D. Number	Performing Calibration	Pre-La calibration		Pre- calibration	Post- calibration	Standard (Lot No.)	and Comments
2/21	SAME	<i>7</i> e	0.00	0.00	10.09	10.00	ت ت ت	P676590 EXP 11/08
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SURFACE WATER SAMPLE LOG SHEET

Page of / Project Site Name: **NSB NEW LONDON** Sample ID No.: S23GWMPM04 Project No.: Sample Location: 112G00777 Site 23 Sampled By: T. Rojahn 4719 [] Stream C.O.C. No.: [] Spring [] Pond Type of Sample: [] Lake [X] Low Concentration [X] Other: ∏ High Concentration Manhole - Monitoring Pit [] QA Sample Type: SAMPLING/DATA: 2-21-08 Other NA W Date: Color На S.C. **Turbidity** DO Salinity Temp. Time: 0925 Visual Standard mS/cm Degrees C NTU mg/l % Depth: NA PLEAK 6.33 0.648 11.76 4c 2.43 18,26 Method: S.S. Beaker SAMPLE COLLECTION IN FORMATION AS Analysis Preservative Collected **Container Requirements** (3) 40 ml VOA Vial 4ºC/HCI Volatiles 3× Yes TCL SVOCS, PAHS & SIM 4°C 3x (2) 1 L Glass Amber Yes Total Oil and Grease 4ºC/H₂SO₄ (2) 1 L Glass Amber 3X Yes 4ºC <u>3x</u> **ETPH** (2) 1 L Glass Amber Yes 4ºC/HNO₃ Total TAL Metals 2X (1) 500 ml HDPE Yes 40C/HNO3 Dissolved TAL Metals 2× (1) 500 ml HDPE Yes Dissolved PAHs 4ºC (2) 1 L Glass Amber Yes 3xDissolved ETPH 4ºC 3X (2) 1 L Glass Amber Yes OBSERVATIONS/INOTES: -MAP:

Circle if App	licable:		Signature(s):	<	•
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| NUMBER 4719

PAGE ____ OF _____

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SAMF	'LERS (SI	GNATURE)		T. F	₹0J	AHN	HIMBER	(4	12)92	?1-8	857	-	600	7ZE	7 7 7 7		ey k	
				FE	0. E)	K. AB	# 8	631	388	7 8	469		SCA	RBC	ROLL	GH,	ME	04074
		Teny Rogali							CONT	AINER TIC (P)	TYPE	SS (G)	/	6/	6/	6/	2/9/	2/6/6
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DATE 2008	TIME	SITE Z3 ROUND 4	LOCATION ID	тор ДЕРТН (FT)	ВОТТОМ DEPTH (FT)	MATRIX (GW, SO, SW, SD, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	THE	C AMA	A VICE	15 AN	75-	Ande Lande	19 19 19 19 19 19 19 19 19 19 19 19 19 1	170 B 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	solved solved	MANENTS
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	LINQUISH			DATE			ГІМЕ		ECEIVE							_	ATE	TIME
	MENTS RIBUTION	* FIRLU FILLERS S. WHITE (ACCOMPANIES S.	AMPLE)			YELLO	W (FIEL	D COPY	"			PII	NK (FILI	E COPY	')			4/02R

APPENDIX B

ROUND 4 DATA VALIDATION LETTER



Tetra Tech NUS

INTERNAL CORRESPONDENCE

TO:

C. RICH

DATE:

APRIL 16, 2008

FROM:

MATTHEW D. KRAUS

COPIES:

DV FILE

SUBJECT:

INORGANIC/ORGANIC DATA VALIDATION - TAL METALS

/VOC/SVOC/PAH/TPH/HEM NSB NEW LONDON - CTO 0073

SDG - SB0921

SAMPLES:

2/Aqueous/

S23GWMPM04

TB022108-01

Overview

The sample set for CTO 0073, NSB New London, SDG: SB0921, consists of one aqueous environmental sample and one field quality control blank.

Both samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs). Sample S23GWMPM04 was also analyzed for semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), total and dissolved total petroleum hydrocarbons (TPH), total and dissolved target analyte list (TAL) metals and oil and grease: hexane extractable materials (O&G:HEM). The samples were collected by Tetra Tech NUS on February 21, 2008 and analyzed by Katahdin Analytical under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The VOC, SVOC/PAH, TPH, metals, mercury and O&G: HEM analyses were conducted in accordance with SW-846 methods OLC03.2, 8270C, CT-ETPH, 6010B, 7470A and EPA method 1664, respectively. Gas chromatography/Mass Spectrometer (GC/MS), GC/MS with a Selective Ion Monitor (SIM), GC/Flame Ionization Detector (FID), Inductively Couple Plasma-Atomic Emission Spectrometer (ICP-AES), Cold Vapor Atomic Absorption (CVAA) and gravimetric instrumentation and methodologies were used to evaluate VOCs/SVOCs, PAHs, TPHs, metals, mercury, and O&G: HEM, respectively.

Data were evaluated based on the following parameters:

- Data Completeness
 - Holding Times
- GC/MS Instrument Tuning
 - Initial and Continuing Calibration Recoveries
 - Laboratory Method/Preparation Blank Analyses
 - Matrix Spike Recoveries
 - Laboratory Control Sample Recoveries
- ICP Serial Dilution
 - Surrogate Recoveries
- Internal Standard Recoveries
 - Detection Limits
- Sample Quantitation
- * All quality control criteria were met for this parameter.

TO: RICH, C. – PAGE 2 DATE: APRIL 16, 2008

VOC

The percent recoveries (%Rs) reported for the surrogate chloroethane-D5 were greater than the upper quality control limit (126%) for all samples. No validation action was required because all results associated with this surrogate were reported as non-detected.

SVOC

The %Rs of the acid extractable SVOC surrogates 2-fluorophenol, phenol-D6 and 2,4,6-tribromophenol were less than the respective lowest quality control limits for sample S23GWMPM04 on instrument GCMS-R on 02/07/08. The %R's of 2-fluorophenol and phenol-D6 were less than 10%. According to the case narrative, sample S23GWMPM04 was re-extracted for SVOCs six days beyond on the holding time and re-analyzed as instructed by the client. A re-analysis of sample S23GWMPM04 for SVOCs occurred on 03/06/08. All SVOC sample results are reported from the 03/06/08 analysis because using the 02/29/08 data would result in the rejection of acid extractable compound data. The non-detected results reported for SVOCs results are qualified as estimated, "UJ", due to extraction holding time exceedance.

The laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) %Rs for 3,3'-dichlorobenzidine were greater than the upper quality control for WG48980-LCS and WG48980-LCSD on instrument GCMS-R at 11:59 on 03/06/08 affecting sample S23GWMPM04. No data was qualified because the affected 3,3'-dichlorobenzidine result was reported as non-detected.

The LCS %R for bis(2-chloroethoxy)methane was greater than the upper quality control for WG48980-LCS on instrument GCMS-R at 11:59 on 03/06/08 affecting sample S23GWMPM04. No data was qualified because the affected bis(2-chloroethoxy)methane result was reported as non-detected.

The matrix spike (MS) and matrix spike duplicate analyses (MSD) of sample S23GWMPM04 yielded %Rs for 2,4-dimethylphenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol that were less than respective lower quality control limits but greater than 10%. The affected non-detected results reported for the aforementioned compounds were qualified as estimated, "UJ".

The MSD analysis of sample S23GWMPM04 yielded a %R for 3&4-methylphenol that was less than the lower quality control limit but greater than 10%. The MS analysis of sample S23GWMPM04 yielded a %R for 3&4-methylphenol that was within quality control limits. The affected non-detected results reported for the aforementioned compounds were qualified as estimated, "UJ".

<u>PAH</u>

The continuing calibration percent differences (%Ds) for 2-methynaphthalene, acenaphthene, fluorene, 4-nitroaniline, pentachlorophenol, benzo(b)fluoranthene and benzo(a)pyrene were outside of the ±25% criteria on instrument GCMS-U at 12:07 on 03/05/08. No environmental data was qualified because only the laboratory control sample (LCS) WG48714-LCS was affected.

The continuing calibration %Ds for 2-methylnaphthalene, fluorene, 4-nitroaniline, pentachlorophenol, bis(2-ethylhexyl)phthalate, and indeno(1,2,3-cd)pyrene were outside of the ±25% criteria on instrument GCMS-U at 09:08 on 03/06/08 affecting the total and dissolved analyses of sample S23GWMPM04. The positive and non-detected results reported for the aforementioned compounds were qualified as estimated, "J" or "UJ", respectively, except for the affected dissolved pentachlorophenol result which was qualified as rejected, "UR", due to surrogate noncompliance.

TO: RICH, C. – PAGE 3
DATE: APRIL 16, 2008

The initial calibration percent relative standard deviation (%RSD) for 4-nitroaniline on instrument GCMS-U on 03/08/08 was greater than 30%. No environmental data was qualified because only the PAH method blank was affected.

Six compounds yielded %Ds outside of the ±25% criteria on instrument GCMS-U at 10:40 on 03/11/08. No environmental data was qualified because only the PAH method blank was affected.

The %R of the surrogate 2,4-dibromophenol was less than the lower quality control limit but greater than 10% for the total PAH analysis of sample S23GWMPM04. The total non-detected result reported for pentachlorophenol was qualified as estimated, "UJ".

The %R of the surrogate 2,4-dibromophenol was less than 10% for the dissolved PAH analysis of sample S23GWMPM04. The dissolved non-detected result reported for pentachlorophenol was qualified as rejected. "UR".

The %R for 2,4-dibromophenol was less than 10% in all MS and MSD analyses. No validation action was taken.

The MS and MSD %Rs for dissolved pentachlorophenol from sample S23GWMPM-04 were less than the lower quality control limit and greater than 10%. No validation action was taken because the affected pentachlorophenol result was previously qualified due to a more severe noncompliance.

The PAH MS/MSD filtered relative percent difference (RPD) for hexachlorobutadiene was greater than the upper quality control limit. No action was taken because the %Rs for both the MS and MSD for hexachlorobutadiene were acceptable.

Metals

The following contaminants were detected in laboratory method/preparation blanks at the following maximum concentrations:

	<u>Maximum</u>	<u>Action</u>
<u>Analyte</u>	Concentration	<u>Level</u>
Barium	0.59 μg/L	2.95 μg/L
Cadmium	0.19 μg/L	0.95 μg/L
Iron	7.21 μg/L	36.0 μg/L
Magnesium	8.64 μg/L	43.2 μg/L
Sodium (1)	307 μg/L	1535 μg/L
Thallium	14.2 μg/L	71.0 µg/L
Zinc (1)	1.80 μg/L	9.00 μg/L

⁽¹⁾ Maximum concentration present in a laboratory method preparation blank affecting all samples.

An action level of five times the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. No data was qualified due to laboratory blank contamination.

Detection Limits

The required quantitation limit (RQL) listed in the laboratory SOW of 1.0 mg/L for O&G:HEM was not met by the laboratory which reported an O&G: HEM method detection limit (MDL) of 1.2 mg/L.

TO: RICH, C. – PAGE 4
DATE: APRIL 16, 2008

Notes

Several results were qualified as estimated, "J", due to uncertainty near the detection limit.

The %Rs for the surrogate 2-fluorophenol were less than the lower quality control limit but greater than 10% the matrix spike (MS) and matrix spike duplicate (MSD) analysis of sample S23GWMPM04. No data was qualified because no environmental samples were directly affected.

The compounds bis(2-ethylhexyl)phthalate, 4-nitroaniline, hexachlorobenzene, hexachlorobutadiene and pentachlorophenol were analyzed and reported with the PAHs by the laboratory instead of a SVOCs as listed in the laboratory scope-of-work (SOW). The laboratory used GC/MS SIM instrumentation in order to achieve detection limits required in the laboratory SOW. The required detection limits listed for bis(2-ethylhexyl)phthalate, 4-nitroaniline, hexachlorobenzene, hexachlorobutadiene and pentachlorophenol in the laboratory SOW were achieved.

Several dissolved PAH compound and dissolved metal analyte results were slightly greater than corresponding total PAH and total metal analyte results which is theoretically impossible.

The Practical Quantitation Limit (PQL) standard analyzed on 02/27/08 at 14:26 yielded a %R for barium that was above quality control limits. No data was qualified because the PQL with the noncompliant barium %R was not associated with the environmental samples contained in this SDG.

Executive Summary

Laboratory Performance: Several SVOC compound results were qualified due to calibration noncompliance. All SVOC results were qualified as estimated due to holding time exceedance.

Other Factors Affecting Data Quality: The dissolved pentachlorophenol result was qualified as rejected due to surrogate recovery noncompliance.

The data for these analyses were reviewed with reference to the "USEPA CLP National Functional Guidelines for Low Concentration Organic Data Review", June 2001, "USEPA Region 1 Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", December 1996, "USEPA Region 1 Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses", June 1988, and the (DOD) QSM document entitled "Quality Systems Manual (QSM) for Environmental Laboratories" (January 2006).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the (DOD) QSM Guidelines."

Tetra Tech NUS Matthew D. Kraus Environmental Chemist

Terra Tech NUS Joseph A. Samchuck Quality Assurance Officer

Attachments:

TO: RICH, C. - PAGE 5 **APRIL 16, 2008** DATE:

1.

Appendix A - Qualified Analytical Results
Appendix B - Results as reported by the Laboratory
Appendix C - Regional Worksheets
Appendix D - Support Documentation

2. 3. 4.

APPENDIX A QUALIFIED ANALYTICAL RESULTS

Data Validation Qualifier Codes:

Υ

Ζ

= Percent solids <30%

= Uncertainty at 2 sigma deviation is greater than sample activity

Α = Lab Blank Contamination В = Field Blank Contamination С = Calibration Noncompliance (e.g. %RSDs, %Ds, ICVs, CCVs, RRFs, etc.) C01 = GC/MS Tuning Noncompliance D = MS/MSD Recovery Noncompliance Ε = LCS/LCSD Recovery Noncompliance F = Laboratory Duplicate Imprecision G = Field Duplicate Imprecision Н = Holding Time Exceedance = ICP Serial Dilution Noncompliance = GFAA PDS - GFAA MSA's r < 0.995 / ICP PDS Recovery Noncompliance J Κ = IPC Interference - included ICS %R Noncompliance L = Instrument Calibration Range Exceedance М = Sample Preservation Noncompliance = Internal Standard Noncompliance Ν N₀1 = Internal Standard Recovery Noncompliance Dioxins N₀2 = Recovery Standard Noncompliance Dioxins N₀3 = Clean-up Standard Noncompliance Dioxins 0 = Poor Instrument Performance (e.g. base-line drifting) P = Uncertainty near detection limit (< 2 x IDL for inorganics and < CRDL for organics) Q = Other problems (can encompass a number of issues; e.g. chromatography, interferences, etc.) R = Surrogate Recovery Noncompliance S = Pesticide/PCB Resolution T = % Breakdown Noncompliance for DDT and Endrin U = % Difference between columns/detectors > 25% for positive results determined via GC/HPLC = Non-linear calibrations; correlation coefficient r < 0.995 W = EMPC result Х = Signal to noise response drop

SDG: SB0921 MEDIA: WATER DATA FRACTION: OV

 nsample
 \$23GWMPM04

 samp_date
 2/21/2008

 lab_id
 \$B0921-2

 qc_type
 NM

 units
 UG/L

 Pct_Solids
 0.0

nsample samp_date lab_id qc_type units Pct_Solids DUP_OF: S23GWMPM04 2/21/2008 SB0921-2 NM UG/L

0.0

qc_type units Pct_Solids DUP_OF:

nsample

lab_id

samp_date

TB022108-01 2/21/2008 SB0921-1 NM UG/L

0.0

		Val	Qual
Parameter	Result	Qual	Code
1,1,1-TRICHLOROETHANE	0.5	U	
1,1,2,2-TETRACHLOROETHANE	0.5	U	
1,1,2-TRICHLOROETHANE	0.5	U	
1,1,2-TRICHLOROTRIFLUOROETHANE	0.5	U	-
1,1-DICHLOROETHANE	0.5	U	
1,1-DICHLOROETHENE	0.5	U	
1,2,3-TRICHLOROBENZENE	0.5	U	
1,2,4-TRICHLOROBENZENE	0.5	U	
1,2-DIBROMO-3-CHLOROPROPANE	0.5	U	
1,2-DIBROMOETHANE	0.5	U	
1,2-DICHLOROBENZENE	0.5	U	
1,2-DICHLOROETHANE	0.5	U	
1,2-DICHLOROPROPANE	0.5	U	
1,3-DICHLOROBENZENE	0.5	U	
1,4-DICHLOROBENZENE	0.5	U	
2-BUTANONE	5.0	Ü	
2-HEXANONE	5.0	U	
4-METHYL-2-PENTANONE	5.0	U	
ACETONE	5.0	Ų	
BENZENE	0.2	J	Р
BROMOCHLOROMETHANE	0.5	Ü.	
BROMODICHLOROMETHANE	0.5	U	
BROMOFORM	0.5	U	
BROMOMETHANE	0.5	U	
CARBON DISULFIDE	0.5	U	
CARBON TETRACHLORIDE	0.5	U	
CHLOROBENZENE	0.5	U	
CHLORODIBROMOMETHANE	0.5	U	
CHLOROETHANE	0.5	U	
CHLOROFORM	0.5	U	
CHLOROMETHANE	0.5	U	
CIS-1,2-DICHLOROETHENE	0.2	J	Р

	Parameter	Result	Val Qual	Qual Code
1	CIS-1,3-DICHLOROPROPENE	0.5	U	
1	CYCLOHEXANE	0.5	U	
1	DICHLORODIFLUOROMETHANE	0.5	U	
1	ETHYLBENZENE	0.5	U	
1	ISOPROPYLBENZENE	0.5	U	
1	METHYL ACETATE	0.5	U	
١	METHYL CYCLOHEXANE	0.5	U	
	METHYL TERT-BUTYL ETHER	0.7		
	METHYLENE CHLORIDE	0.5	U	
1	STYRENE	0.5	υ	
1	TETRACHLOROETHENE	0.3	J	P
	TOLUENE	0.5	U	
1	TOTAL XYLENES	0.5	U	,
1	TRANS-1,2-DICHLOROETHENE	0.5	Ū	
٦	TRANS-1,3-DICHLOROPROPENE	0.5	U	
1	TRICHLOROETHENE	0.4	J	Р
	TRICHLOROFLUOROMETHANE	0.5	Ú	
	VINYL CHLORIDE	0.5	υ	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	0.5	U	
1,1,2,2-TETRACHLOROETHANE	0.5	U	
1,1,2-TRICHLOROETHANE	0.5	U	
1,1,2-TRICHLOROTRIFLUOROETHANE	0.5	. U	
1,1-DICHLOROETHANE	0.5	U	
1,1-DICHLOROETHENE	0.5	U	
1,2,3-TRICHLOROBENZENE	0.5	U	
1,2,4-TRICHLOROBENZENE	0.5	U	
1,2-DIBROMO-3-CHLOROPROPANE	0.5	U	
1,2-DIBROMOETHANE	0.5	U	
1,2-DICHLOROBENZENE	0.5	U	
1,2-DICHLOROETHANE	0.5	U	
1,2-DICHLOROPROPANE	0.5	U	
1,3-DICHLOROBENZENE	0.5	U	
1,4-DICHLOROBENZENE	0.5	U	
2-BUTANONE	5.0	U	
2-HEXANONE	5.0	U	
4-METHYL-2-PENTANONE	5.0	U	
ACETONE	5.0	. U	
BENZENE	0.5	U	
BROMOCHLOROMETHANE	0.5	υ	
BROMODICHLOROMETHANE	0.5	U	
BROMOFORM	0.5	U	
BROMOMETHANE	0.5	U	
CARBON DISULFIDE	0.5	U	
CARBON TETRACHLORIDE	0.5	U	
CHLOROBENZENE	0.5	U	
CHLORODIBROMOMETHANE	0.5	U	
CHLOROETHANE	0.5	U	
CHLOROFORM	0.5	U	
CHLOROMETHANE	0.5	U	
CIS-1,2-DICHLOROETHENE	0.5	U	

00777 SDG: SB0921 MEDIA: WATER DATA FRACTION: OV

nsample

TB022108-01

samp_date

2/21/2008

lab_id

SB0921-1

qc_type

NM

units

UG/L

Pct_Solids

0.0

		Val	Qual
Parameter	Result	Qual	Code
CIS-1,3-DICHLOROPROPENE	0.5	U	
CYCLOHEXANE	0.5	U	
DICHLORODIFLUOROMETHANE	0.5	U	
ETHYLBENZENE	0.5	U	
ISOPROPYLBENZENE	0.5	U	
METHYL ACETATE	0.5	U	
METHYL CYCLOHEXANE	0.5	U	
METHYL TERT-BUTYL ETHER	0.5	U	
METHYLENE CHLORIDE	0.5	U	
STYRENE	0.5	U	
TETRACHLOROETHENE	0.5	U	
TOLUENE	0.5	U	
TOTAL XYLENES	0.5	U .	
TRANS-1,2-DICHLOROETHENE	0.5	U	
TRANS-1,3-DICHLOROPROPENE	0.5	U	
TRICHLOROETHENE	0.5	U	
TRICHLOROFLUOROMETHANE	0.5	U	
VINYL CHLORIDE	0.5	U	

SDG: SB0921 MEDIA: WATER DATA FRACTION: OS

S23GWMPM04 nsample 2/21/2008 samp_date SB0921-2RE lab_id NM qc_type UG/L units

Pct_Solids 0.0

DUP_OF:

nsample	S23GWMPM04
samp_date	2/21/2008
lab_id	SB0921-2RE
qc_type	NM
units	UG/L
Pct_Solids	0.0

		Val	Qual
Parameter	Result	Qual	Code
2,2'-OXYBIS(1-CHLOROPROPANE)	10.0	UJ	Н
2,4,5-TRICHLOROPHENOL	26.0	UJ	Н
2,4,6-TRICHLOROPHENOL	10	UJ	DH
2,4-DICHLOROPHENOL	10	UJ	DH
2,4-DIMETHYLPHENOL	10.0	UJ	DH
2,4-DINITROPHENOL	26.0	UJ	Н
2,4-DINITROTOLUENE	10.0	UJ	Н
2,6-DINITROTOLUENE	10	UJ	Н
2-CHLORONAPHTḤALENE	10.0	UJ	Н
2-CHLOROPHENOL	10.0	UJ	Н
2-METHYLPHENOL	10	IJ	Н
2-NITROANILINE	26	UJ	Н
2-NITROPHENOL	10.0	UJ	Н
3&4-METHYLPHENOL	10.0	UJ	DH
3,3'-DICHLOROBENZIDINE	10.0	UJ	Н
3-NITROANILINE	26.0	UJ	Н
4,6-DINITRO-2-METHYLPHENOL	26.0	UJ	Н
4-BROMOPHENYL PHENYL ETHER	10.0	UJ	Н
4-CHLORO-3-METHYLPHENOL	10.0	ŲJ	Н
4-CHLOROANILINE	10.0	UJ	Н
4-CHLOROPHENYL PHENYL ETHER	10.0	UJ	Н
4-NITROPHENOL	26.0	UJ	Н
BIS(2-CHLOROETHOXY)METHANE	10	UJ	Н
BIS(2-CHLOROETHYL)ETHER	10	UJ	Н
BUTYL BENZYL PHTHALATE	10	UJ	Н
CARBAZOLE	10	IJ	Н
DIBENZOFURAN	10.0	UJ	Н
DIETHYL PHTHALATE	10.0	UJ	Н
DIMETHYL PHTHALATE	10	UJ	Н
DI-N-BUTYL PHTHALATE	10	UJ	Н
DI-N-OCTYL PHTHALATE	10	UJ	Н
HEXACHLOROCYCLOPENTADIENE	10	UJ	Н

Parameter	Result	Val Qual	Qual Code
HEXACHLOROETHANE	10	UJ	Н
ISOPHORONE	10.0	UJ	Н
NITROBENZENE	10	UJ	Н
N-NITROSO-DJ-N-PROPYLAMINE	10.0	UJ	Н
N-NITROSODIPHENYLAMINE	10	UJ	Н
PHENOL	10	UJ	Н

00777

SDG: SB0921 MEDIA: WATER DATA FRACTION: PET

nsample

S23GWMPM04

samp_date

2/21/2008

lab_id

SB0921-2

qc_type

NM

0.0

Pct_Solids

Parameter	units	Result		Qual Code
TOTAL PETROLEUM HYDROCAR	UG/L	75.0	U	

00777

SDG: SB0921 MEDIA: WATER DATA FRACTION: PETF

nsample

S23GWMPM04-F

samp_date

2/21/2008

lab_id

SB0921-4

qc_type

NM

Pct_Solids

0.0

Parameter	units	Result		Qual Code
TOTAL PETROLEUM HYDROCAR	UG/L	75.0	· U	

SDG: SB0921 MEDIA: WATER DATA FRACTION: PAH

 nsample
 \$23GWMPM04

 samp_date
 2/21/2008

 lab_id
 \$B0921-3

 qc_type
 NM

units UG/L
Pct_Solids 0.0

DUP_OF:

nsample S23GWMPM04-F samp date 2/21/2008

 samp_date
 2/21/2008

 lab_id
 SB0921-4

 qc_type
 NM

 qc_type
 NM

 units
 UG/L

 Pct_Solids
 0.0

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.21	U	
2-METHYLNAPHTHALENE	0.21	UJ	С
4-NITROANILINE	1.0	UJ	С
ACENAPHTHENE	0.21	U	
ACENAPHTHYLENE	0.21	U	
ANTHRACENE	0.21	U	
BENZO(A)ANTHRACENE	0.045	U	
BENZO(A)PYRENE	0.21	U	
BENZO(B)FLUORANTHENE	0.082	U	
BENZO(G,H,I)PERYLENE	0.21	U	
BENZO(K)FLUORANTHENE	0.21	U.	
BIS(2-ETHYLHEXYL)PHTHALATE	1.0	UJ	C.
CHRYSENE	0.21	U	
DIBENZO(A,H)ANTHRACENE	0.21	U	
FLUORANTHENE	0.21	U	
FLUORENE	0.21	UJ	С
HEXACHLOROBENZENE	0.21	U	
HEXACHLOROBUTADIENE	0.21	Ú.	
INDENO(1,2,3-CD)PYRENE	0.21	UJ	С
NAPHTHALENE	0.21	U	
PENTACHLOROPHENOL	1.0	3	CR
PHENANTHRENE	0.21	٥	
PYRENE	0.21	ט	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.093	J	P.
2-METHYLNAPHTHALENE	0.2	UJ	С
4-NITROANILINE	1.0	UJ	С
ACENAPHTHENE	0.031	J	Р
ACENAPHTHYLENE	0.2	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.042	U	
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.078	U	
BENZO(G,H,I)PERYLENE	0.13	J	· P
BENZO(K)FLUORANTHENE	0.2	U	
BIS(2-ETHYLHEXYL)PHTHALATE	1.0	ŲĴ	С
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	0.2	ÚJ	С
HEXACHLOROBENZENE	0.2	U	
HEXACHLOROBUTADIENE	0.2	Ü	
INDENO(1,2,3-CD)PYRENE	0.22	J	С
NAPHTHALENE	0.069	J	Р
PENTACHLOROPHENOL	1.0	UR	R
PHENANTHRENE	0.2	U	
PYRENE	0.2	U	

SDG: SB0921 MEDIA: WATER DATA FRACTION: M

nsample

S23GWMPM04

samp_date

2/21/2008

lab_id

SB0921-002

qc_type

NM

units

UG/L

Pct_Solids

0.0

		Val	Qual
Parameter	Result	Qual	Code
ALUMINUM	29.4		
ANTIMONY	1.5	U	
ARSENIC	3.1		
BARIUM	55.9		
BERYLLIUM	0.12	U	
CADMIUM	0.1	U	
CALCIUM	34300		
CHROMIUM	0.38	U.	
COBALT	0.6		
COPPER	0.8	U	
IRON	4380		
LEAD	1.4	Ų	
MAGNESIUM	7540		
MANGANESE	784		
MERCURY	0.02	U	
NICKEL	0.64		
POTASSIUM	5150		
SELENIUM	2.2	U	
SILVER	0.54	U	
SODIUM	50100		
THALLIUM	2.0	U	
VANADIUM	0.52	U	
ZINC	26.6		

SDG: SB0921 MEDIA: WATER DATA FRACTION: MF

nsample

S23GWMPM04-F

samp_date

2/21/2008

lab_id

SB0921-004

qc_type

NM

units

UG/L

Pct_Solids

0.0

Parameter	Result	Val Qual	Qual Code
ALUMINUM	35.4	****	
ANTIMONY	1.5	U	
ARSENIC	2.8		
BARIUM	56.8		
BERYLLIUM	0.12	U	
CADMIUM	0.1	U	
CALCIUM	36000		
CHROMIUM	0.38	U	
COBALT	0.64		
COPPER	0.8	U	
IRON	3750		
LEAD	1.4	U	
MAGNESIUM	. 8020		
MANGANESE	815		
MERCURY	0.02	U	
NICKEL	0.66		
POTASSIUM	5390		
SELENIUM	2.2	U	
SILVER	0.54	U	
SODIUM	52100		
THALLIUM	2.0	U	
VANADIUM	0.52	U	
ZINC	26.0		

00777

SDG: SB0921 MEDIA: WATER DATA FRACTION: MISC

nsample

S23GWMPM04

samp_date

2/21/2008

lab_id

SB0921-2

qc_type

NM

0.0

Pct_Solids

Parameter	units	Result		Val Qual	Qual Code
OIL & GREASE - HEM	MG/L	1.2	U	U	

YEAR 1 ANALYTICAL DATABASE

COMPLETE ANALYTICAL DATABASE - ROUNDS 1 THROUGH 4 SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 1 OF 4

nsample	S23GWMPM01	S23GWMPM01-AVG	S23GWMPM01-D	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	S23GWMPM-03-D	S23GWMPM04
location	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01
sample_coc	S23GWMPM01	S23GWMPM01-AVG	FD-061807	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	FD121807-01	S23GWMPM04
sample_dat	20070618	20070618	20070618	20070906	20071218	20071218	20071218	20080221
sacode	ORIG	AVG	DUP	NORMAL	ORIG	AVG	DUP	NORMAL
duplicate			S23GWMPM01				S23GWMPM-03	ŀ
Volatile Organics (ug/L)								
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
1,1,2-TRICHLOROTRIFLUOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMOETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE	0.5 U	0.5 U	0.5 Ų	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE	0.5 U	Q.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-BUTANONE	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-HEXANONE	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-METHYL-2-PENTANONE	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
ACETONE	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J
BROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMODICHLOROMETHANE	0.3 J	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON DISULFIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 Ü	0.5· U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLORODIBROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 UJ	0.5 UJ	Q.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	3 J	2.5 J	2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHENE	0.3 J	0.25 J	0.2 J	0.3 J	0.2 J	0.2 J	0.5 U	0.2 J
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
ISOPROPYLBENZENE	0.1 J	0.095 J	0.09 J	0.1 J	0.5 U	0.5 UJ	0.5 UJ	0.5 U
METHYL ACETATE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYL CYCLOHEXANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYL TERT-BUTYL ETHER	1	0.95	0.9	0.4 J	0.6	0.6	0.6	0.7
METHYLENE CHLORIDE	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
TETRACHLOROETHENE	0.3 J	0.3 J	0.3 J	0.4 J	0.3 J	0.25 J	0.2 J	0.3 J
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
TOTAL XYLENES	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U
TRICHLOROETHENE	0.4 J	0.35 J	0.3 J	0.5 J	0.4 J	0.35 J	0.3 J	0.4 J
TRICHLOROFLUOROMETHANE	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

COMPLETE ANALYTICAL DATABASE - ROUNDS 1 THROUGH 4 SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 2 OF 4

	T	····						
nsample	S23GWMPM01	S23GWMPM01-AVG	S23GWMPM01-D	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	S23GWMPM-03-D	S23GWMPM04
location	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01
sample_coc	S23GWMPM01	S23GWMPM01-AVG	FD-061807	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	FD121807-01	S23GWMPM04
sample_dat	20070618	20070618	20070618	20070906	20071218	20071218	20071218	20080221
sacode	ORIG	AVG	DUP	NORMAL	ORIG	AVG	DUP	NORMAL
duplicate			S23GWMPM01			•	S23GWMPM-03	
Semivolatile Organics (ug/L)							•	
2,2'-OXYBIS(1-CHLOROPROPANE)	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2,4,5-TRICHLOROPHENOL	25 U	25 U	25 U	25 U	25 UJ	25 UJ	25 U	26 UJ
2,4,6-TRICHLOROPHENOL	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ
2,4-DICHLOROPHENOL	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2,4-DIMETHYLPHENOL	10 UJ	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ
2,4-DINITROPHENOL	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	26 UJ
2,4-DINITROTOLUENE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2,6-DINITROTOLUENE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2-CHLORONAPHTHALENE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2-CHLOROPHENOL	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ
2-METHYLPHENOL	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
2-NITROANILINE	25 U	25 U	25 U	25 U	25 UJ	25 UJ	25 U	26 UJ
2-NITROPHENOL	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
3&4-METHYLPHENOL	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
3,3'-DICHLOROBENZIDINE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ
3-NITROANILINE	25 U	25 U	25 U	25 U	25 UJ	25 UJ	25 UJ	26 UJ
4,6-DINITRO-2-METHYLPHENOL	25 U	25 U	25 U	25 UJ	25 UJ	25 UJ	25 UJ	26 UJ
4-BROMOPHENYL PHENYL ETHER	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
4-CHLORO-3-METHYLPHENOL	25 U	25 U	25 U	10 U	10 UJ	10 UJ	10 U	10 UJ
4-CHLOROANILINE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
4-CHLOROPHENYL PHENYL ETHER	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
4-NITROPHENOL	25 UJ	25 UJ	25 UJ	25 U	25 UJ	25 W	25 UJ	26 UJ
BIS(2-CHLOROETHOXY)METHANE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
BIS(2-CHLOROETHYL)ETHER	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
BUTYL BENZYL PHTHALATE	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ
CARBAZOLE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
DI-N-BUTYL PHTHALATE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
DI-N-OCTYL PHTHALATE	10 UJ	10 UJ	10 UJ	10 U	10 UJ	10 UJ	10 U	10 UJ
DIBENZOFURAN	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
DIETHYL PHTHALATE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
DIMETHYL PHTHALATE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
HEXACHLOROCYCLOPENTADIENE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ
HEXACHLOROETHANE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
ISOPHORONE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
N-NITROSO-DI-N-PROPYLAMINE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
N-NITROSODIPHENYLAMINE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
NITROBENZENE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ
PHENOL	10 U	10 Ü	10 U	10 U	10 ÚJ	10 UJ	10 U	10 UJ
PAHs (ug/L)								
1-METHYLNAPHTHALENE	0.2 U	0.2 U	0.2 U	0.2 U	0.96 J	0.504 J	0.048 J	0.21 U
2-METHYLNAPHTHALENE	0.17 J	0.165 J	0.16 J	0.2 U	1.1 J	0.6 J	0.2 UJ	0.21 UJ
4-NITROANILINE	0.2 U	0.2 U	0.2 U	1 UJ	0.75 J	0.75 J	1 UR	1 UJ
ACENAPHTHENE	0.2 U	0.2 U	0.2 U	0.2 U	0.83 J	0.4295 J	0.029 J	0.21 U
ACENAPHTHYLENE	0.2 U	0.2 U	0.2 U	0.2 U	0.9 J	0.5 J	0.2 UJ	0.21 U
ANTHRACENE PENZO(A) ANTHRACENE	0.2 U	0.2 U	0.2 U	0.2 U	0.92 J	0.51 J	0.2 W	0.21 U
BENZO(A)ANTHRACENE BENZO(A)PYRENE	0.07 U	0.07 U	0.07 U	0.041 U	1 J	0.5105 J	0.042 UJ	0.045 U
	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.35 J	0.225 J	0.2 U	0.21 U
BENZO(B) FLUORANTHENE	0.08 U	0.08 U	0.08 U	0.075 U	0.64 J	0.3395 J	0.078 UJ	0.082 U
BENZO(G,H,I)PERYLENE BENZO(K)FLUORANTHENE	0.2 UJ 0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.31	0.205	0.2 U	0.21 U
BIS(2-ETHYLHEXYL)PHTHALATE	0.2 UJ 1 UJ	0.2 UJ	0.2 UJ	0.2 U	0.53 J	0.315 J	0.2 U	0.21 U
DIO(2-ETHTEREATE)FHITHALATE	1 00	1 UJ	1 UJ	1 U	1 U	. 1 U	1 U	1 UJ

COMPLETE ANALYTICAL DATABASE - ROUNDS 1 THROUGH 4 SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 3 OF 4

nsample	S23GWMPM01	S23GWMPM01-AVG	S23GWMPM01-D	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	S23GWMPM-03-D	S23GWMPM04
location	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01
sample_coc	S23GWMPM01	S23GWMPM01-AVG	FD-061807	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	FD121807-01	S23GWMPM04
sample_dat	20070618	20070618	20070618	20070906	20071218	20071218	20071218	20080221
sacode	ORIG	AVG	DUP	NORMAL	ORIG	AVG	DUP	NORMAL
duplicate			S23GWMPM01				S23GWMPM-03	
PAHs (continued) (ug/L)								
CHRYSENE	0.2 U	0.2 U	0.2 U	0.2 U	0.76 J	0.43 J	0.2 UJ	0.21 U
DIBENZO(A,H)ANTHRACENE	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.14 J	0.14 J	0.2 U	0.21 U
FLUORANTHENE	0.2 U	0.2 U	0.2 U	0.2 U	1.1 J	0.6 J	0.2 UJ	0.21 U
FLUORENE	0.2 U	0.2 U	0.2 U	0.2 U	0.97 J	0.535 J	0.2 UJ	0.21 UJ
HEXACHLOROBENZENE	1 U	1 U	1 U	0.2 U	1.2 J	0.65 J	0.2 UJ	0.21 U
HEXACHLOROBUTADIENE	0.2 U	0.2 U	0.2 U	0.48 U	0.64 J	0.3448 J	0.099 U	0.21 U
INDENO(1,2,3-CD)PYRENE	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.22	0.16	0.2 U	0.21 UJ
NAPHTHALENE	0.2 U	0.2 U	0.2 U	0.2 U	1 J	0.544 J	0.088 J	0.21 U
PENTACHLOROPHENOL	1 UR	1 UR	1 UR	1 UR	1 UR	1 UR	1 UR	1 UJ
PHENANTHRENE	0.2 U	0.2 U	0.2 U	0.2 U	0.98 J	0.54 J	0.2 UJ	0.21 U
PYRENE	0.2 U	0.2 U	0.2 U	0.2 U	0.84 J	0.47 J	0.2 UJ	0.21 U
PAHs, Filtered (ug/L)								
1-METHYLNAPHTHALENE	T	· · · · · · · · · · · · · · · · · · ·						0.093 J
2-METHYLNAPHTHALENE								0.2 UJ
4-NITROANILINE	1							1 UJ
ACENAPHTHENE	·						•	0.031 J
ACENAPHTHYLENE	1				· · · · · · · · · · · · · · · · · · ·			0.2 U
ANTHRACENE	*							0.2 U
BENZO(A)ANTHRACENE								0.042 U
BENZO(A)PYRENE								0.2 U
BENZO(B)FLUORANTHENE			*********** †					0.078 U
BENZO(G,H,I)PERYLENE	-							0.13 J
BENZO(K)FLUORANTHENE	+							0.2 U
BIS(2-ETHYLHEXYL)PHTHALATE	 							1 UJ
CHRYSENE	 							0.2 U
DIBENZO(A,H)ANTHRACENE	 							0.2 U
FLUORANTHENE		<u> </u>						0.2 U
FLUORENE								0.2 UJ
HEXACHLOROBENZENE	 							0.2 U
HEXACHLOROBUTADIENE								0.2 U
INDENO(1,2,3-CD)PYRENE	-							0.22 J
NAPHTHALENE	 							0.069 J
PENTACHLOROPHENOL								1 UR
PHENANTHRENE						·····		0.2 U
PYRENE	 		****					0.2 U
Inorganics (ug/L)			L		اا			0.2 0
ALUMINUM	473	294	115	322	38.1	29.95	21.8	29.4
ANTIMONY	2.3 U	1.9 U	1.5 U	0.87 U	1.8 U	1.45 U	1.1 U	1.5 U
ARSENIC	3.7 U	3.35 U	3.0 U	13.9	2.2 U	3.45 U	4.7 U	3.1
BARIUM	48.2	50.3	52.4	87	55.2	54.3	53.4	55.9
BERYLLIUM	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
CADMIUM	0.12 U	0.12 U	0.12 U	0.64 U	0.12 U	0.1 U	0.12 U	0.1 U
CALCIUM	33800	34800	35800	32000	35500	35100	34700	34300
CHROMIUM	0.94 U	0.875 U	0.81 U	2	0.41	0.275	0.28 U	0.38 U
COBALT	0.94 U	0.875 U	0.64 U	0.26 U	0.66	0.595	0.53	0.6
COPPER	3.0 U	3.0 U	3.0 U	4.2	0.44 U	0.33 U	0.22 U	0.8 U
IRON	9190	10545	11900	70800	9860	10030	10200	4380
LEAD	2.2	5.75	9.3	8.4	2.5 U	2.35 U	2.2 U	1.4 U
	7260	7460	7660	7020	7660	7575	7490	7540
MAGNESIUM	7260 661	7460 688	7660 715	845	858	836.5	7490 815	784
MANGANESE				0.02 U	0.02 U	836.5 0.02 U	0.02 U	0.02 U
MERCURY	0.03 U	0.035 U	0.04 U	0.02 U	0.02 0	0.02 U	0.02 0	0.02 0

COMPLETE ANALYTICAL DATABASE - ROUNDS 1 THROUGH 4 SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNETICUT PAGE 4 OF 4

nsample	S23GWMPM01	S23GWMPM01-AVG	S23GWMPM01-D	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	S23GWMPM-03-D	S23GWMPM04
location	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP01	23MP0
sample_coc	S23GWMPM01	S23GWMPM01-AVG	FD-061807	S23GWMPM02	S23GWMPM-03	S23GWMPM-03-AVG	FD121807-01	S23GWMPM0
sample_dat	20070618	20070618	20070618	20070906	20071218	20071218	20071218	2008022
sacode	ORIG	AVG	DUP	NORMAL	ORIG	AVG	DUP	NORMA
duplicate			S23GWMPM01				S23GWMPM-03	
Inorganics (continued) (ug/L)								
NICKEL	1.0 U	0.885 U	0.77 U	0.41 U	0.53	0.495	0.46	0.64
POTASSIUM	5210	5350	5490	5270	5590	5540	5490	5150
SELENIUM	1.5 U	1.375 J	2.0 J	1.5 U	1.5 U	1.5 U	1.5 U	2.2 U
SILVER	0.46 U	0.46 U	0.46 U	1.5	0.46 U	0.46 U	0.46 U	0.54 U
SODIUM	46900	48250	49600	52100	53400	52850	52300	50100
THALLIUM	0.99 U	1.645 U	2.3 U	0.98 U	0.71 U	. 0.71 U	0.71 U	2.0 U
VANADIUM	1.3 U	1.35 U	1.4 U	3.7	0.34 U	0.315 U	0.29 U	0.52 U
ZINC	21.3 J	21.8 J	22.3	47.1	22.8	21.4	20	26.6
Inorganics, Filtered (ug/L)		<u> </u>			<u></u> 1.			20.0
ALUMINUM	20.4 J	28.55 J	36.7 J	21.3 J	19 U	. 19 U	19 U	35.4
ANTIMONY	0.87 U	1.235 U	1.6 U	0.87 U	0.87 U	1.085 U	1.3 U	1.5 U
ARSENIC	3.5 U	2.85 U	2.2 U	1.2 J	1.9 U	1.5 U	1.1 U	2.8
BARIUM	44.6	45.5	46,4	50.1	48.9	49.25	49.6	56.8
BERYLLIUM	0.12 Ü	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
CADMIUM	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
CALCIUM	33600	34150	34700	31400	33100	33250	33400	36000
CHROMIUM	1.2 U	0.82 U	0.44 U	0.3 J	0.29	0.385	0.48	0.38 U
COBALT	0.67 U	0.765 U	0.86 U	0.47 J	0.48	0.495	0.51	0.36 0
COPPER	14.9 U	8.55 U	2.2 U	0.7 U	0.22 U	0.45 U	0.68 U	0.8 U
IRON	3470	3550	3630	3600	4190	4165	4140	3750
LEAD	1.3 J	1.55 J	1.8 J	1,1 U	2.1 U	2.45 U	2.8 U	1.4 U
MAGNESIUM	7200	7340	7480	6980	7250	7275	7300	
MANGANESE	645	654.5	664	708	764	767	770	8020 815
MERCURY	0.03 U	0.035 U	0.04 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
NICKEL	1.1 Ü	0.99 U	0.88 U	0.78 J	1	0.02 0	0.64	
POTASSIUM	5090	5240	5390	5320	5360	5375	5390	0.66 5390
SELENIUM	1.5 U	1.225 J	1.7 J	2.4 U	1.5 U	1.9 U	2.3 U	
SILVER	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	2.2 U
SODIUM	46600	47500	48400	52600	50400	50900		0.54 U
THALLIUM	1.2 U	1.065 U	0.93 U	1.7 U	0.71 U	0.71 U	51400	52100
VANADIUM	0.7 U	0.63 U	0.56 U	0.29 U	0.71 U		0.71 U	2 U
ZINC	21.4 J	20.45 J	19.5 J	15	18.6	0.29 U	0.29 U	0.52 U
Oil & Grease (ug/L)	21.70	20.40 0	19.0 J	15	18.0	19.7	20.8	26
OIL & GREASE - HEM	1200 U	1200 U	1200 U	1200 U	1000 III T	4000 111		72.2
Petroleum Hydrocarbons (ug/L)	1200 0	1200 0	1200 0	1200 U	1200 UJ	1200 UJ	1200 U	1200 U
TOTAL PETROLEUM HYDROCARBONS	55 J	55 J	79 U	140	100 11			
Petroleum Hydrocarbons, Filtered (ug/L)	1 30 1	55 J	18 O	140 J	160 U	840 J	1600 J	75 U
TOTAL PETROLEUM HYDROCARBONS		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·				
TO TAL TETROLEOW HTD DOUGHDONS								75 U

APPENDIX D

HUMAN HEALTH RISK ASSESSMENT MEMORANDUM

From: Bob Jupin, Tetra Tech Risk Assessment Specialist

To: Corey Rich, Tetra Tech Project Manager

Date: May 19, 2008

Regarding: Human Health Risks Associated with Site 23 Groundwater

Historical and current information pertaining to Site 23 groundwater were reviewed to determine if Site 23 groundwater poses a threat to human health and the environment. Historical information reviewed as part of this evaluation included the Basewide Groundwater Operable Unit Remedial Investigation Report (BGOURI) (Tetra Tech, 2002) and data collected as part of the storm sewer rehabilitation (FWEC, 2001). Current data reviewed as part of this evaluation included the first four quarters of the underdrain metering pit sampling collected through February, 2008.

There have been changes in United States Environmental Protection Agency (USEPA) and Connecticut Department of Environmental Protection (CTDEP) guidance since the BGOURI HHRA was prepared. The major changes in guidance include:

- USEPA Region 9 Preliminary Remedial Goals (2004)
- CTDEP Remediation Standard Regulations (RSRs) Volatilization Criteria (2003)
- Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air (USEPA, 2002).
- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final Guidance (USEPA, 2004).
- Guidelines for Carcinogen Risk Assessment (USEPA, 2005a).
- Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005b).

The revised guidance was used in this evaluation.

Site Description

Figure 1-1 shows the general location of the Naval Submarine Base and Figure 1-2 shows the location of Site 23. No. 2 and No. 6 fuel oil and waste oil were previously stored in underground storage tanks (USTs) at Site 23 and each tank had an underdrain system that collected groundwater to control water levels and associated hydraulic pressure. The USTs were properly closed in place and the underdrain systems were kept to reduce groundwater levels in the area. Evidence of releases of petroleum products from the tanks, their associated piping, and possibly from other nearby sources was detected during previous investigations. Remedial actions were taken to address petroleum products detected in the soil. No significant groundwater contamination was detected; however, low-levels of petroleum hydrocarbons were infrequently detected at the outfall of the storm sewer system near Goss Cove. Subsequently, the

storm sewer at Site 23 was rehabilitated in 2000 such that the original combined groundwater and stormwater system was separated into a deep groundwater and a new shallow stormwater system (FWEC, 2001). Over 2,000 feet of the existing underdrain piping was relined with cured-in-place plastic pipe and a manhole was converted into a metering pit to measure groundwater flow volume.

Current and expected future site usage is industrial/commercial. Groundwater at Site 23 is classified GB. Groundwater at Site 23 is not used as a potable water source. Currently there are no direct contact exposures to groundwater. Potential receptors evaluated in the human health risk assessments for Site 23 included construction workers and hypothetical future residents.

Basewide Groundwater Operable Unit Remedial Investigation Report

Groundwater at Site 23 was evaluated in the BGOURI (Tetra Tech, 2002). As part of the evaluation concentrations of chemicals in groundwater were compare to USEPA and CTDEP screening criteria for direct contact (USEPA Region IX Preliminary Remedial Goals, USEPA Maximum Contaminant Levels, CTDEP Maximum Contaminant Levels, and CTDEP RSRs) and migration (CTDEP volatilization and surface water protection criteria). A copy of the comparisons is included in Attachment A.1. Maximum concentrations of tetrachloroethene, naphthalene, and lead exceeded the direct contact criteria (Table 13-4). Arsenic and lead were detected at concentrations exceeding the surface water protection criteria (Table 13-5). The human health risk assessment (HHRA) evaluated potential risks from exposures to groundwater by construction workers and hypothetical residents. The HHRA determined that risks for construction workers were less than USEPA and CTDEP acceptable levels (Table 13-6). Risk for future residents were within USEPA and CTDEP acceptable levels. However, the chemical specific cancer risk for tetrachloroethene exceeded the CTDEP target level of 1 x 10⁻⁶ for individual chemicals, although the maximum detected concentration of tetrachloroethene was less than its CTDEP RSR. The HHRA guidance has been updated since the BGOURI was prepared, but the changes in the HHRA guidance would not change the conclusions of the HHRA.

Storm Sewer Rehabilitation

The storm sewer system at Site 23 was rehabilitated in 2000 (FWEC, 2001). After completion of the storm sewer system, groundwater collected from the deep dewatering system around the closed underground storage tanks is conveyed to a metering pit within the Tank Farm. The metering pit is connected to the shallow stormwater system and the water is conveyed to the Thames River. Seven groundwater samples were collected from the metering pit between July 25, 2000 and May 23, 2001. A summary of the sample analytical results are included in Table 1 in Attachment A.2. it should be noted that this data was not validated. Table 1 includes a comparison of the data to CTDEP RSRs for surface

water protection and volatilization. Concentrations of all chemicals in all seven groundwater samples were less than the volatilization criteria. Concentrations of total zinc exceeded the surface water protection criteria in samples collected in August and October, 2000. Concentrations of total lead exceeded the surface water protection criteria in samples collected in August 2000, October 2000, January 2001, April 2001, and May 2001. Concentrations of total arsenic exceeded the surface water protection criteria in samples collected in August 2000, October 2000, March 2001, April 2001, and May 2001, although total arsenic was also detected in the blank samples collected in 2001, indicating a potential laboratory blank contamination issue. Concentrations of all inorganics in filtered samples were less than the surface water protection criteria in all samples, suggesting that the elevated total arsenic and lead results were related to suspended soils in the samples. In general, concentrations of inorganics were highest in samples collected in August and October of 2000 shortly after completion of construction of the new storm water system and decreased significantly in subsequent sampling rounds. Concentrations of phenanthrene exceeded the surface water protection criteria in the samples collected in January 2001 and May 2001. Concentrations of benzo(b)fluoranthene, and benzo(k)fluoranthene exceeded the surface water protection criteria in the sample collected in May 2001. Considering the new risk methodology risks for construction workers exposed to groundwater would be within USEPA and CTDEP acceptable levels using the last round of sampling results (May 2001) (Attachment A.3).

Quarterly Underdrain Metering Pit Sampling

Four quarters of water samples were collected from the metering pit (Tetra Tech, 2008), which began in June 2007. The results of the sampling are presented in Table 3-1 in Attachment A.4. Included in Table 3-1 is a comparison to CTDEP RSRs for surface water protection and volatilization. None of the detected concentrations in the samples exceeded CTDEP volatilization criteria. In the sample collected in September 2007, the concentration of total arsenic exceeded the surface water protection criteria. However, the concentration of arsenic in the filtered sample was below the surface water protection criteria. In general concentrations of inorganics in the filtered samples were significantly less than the concentrations detected in the unfiltered samples. Also the sample log sheet indicates that orange precipitate was observed in the sample. Therefore, it is likely that the arsenic detected in the unfiltered sample was a result of suspended solid particles in the water and is not indicative of groundwater quality. Arsenic was not detected in the sample collected in December 2007 and was detected at a concentration below the surface water protection criteria in the sample collected in February 2008. In December 2007, concentrations of acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, hexachlorobenzene, and phenanthrene exceeded the surface water protection criteria. These chemicals were not detected in the duplicate sample collected in December 2007 and these chemicals were not detected in the sample collected in February 2008.

Table 2.1 in Attachment A.5 presents a comparison of the sampling results to human health screening criteria consisting of USEPA Region IX Preliminary Remediation Goals (PRGs) for tap water, USEPA Maximum Contaminant Levels (MCLs), CTDEP RSRs, and Connecticut MCLs. Several VOCs, SVOCs, and inorganics were detected at concentrations exceeding the human health screening criteria. Attachment A.5 also presents the results of a human health risk assessment (HHRA) for construction workers and hypothetical residents exposed to groundwater from the underdrain metering pit. Risks for construction workers exposed to groundwater are within USEPA and CTDEP acceptable levels. Cancer risks and hazard indices for hypothetical residents exceed USEPA and CTDEP acceptable levels, although Site 23 is not suitable for residential development. Hexachlorobenzene, carcinogenic PAHs, and arsenic were the major contributors to the cancer risks. Arsenic, iron, and manganese are the major contributors to the hazard indices. As discussed above hexachlorobenzene and carcinogenic PAHs were only detected in the sample collected in December 2007. Concentrations of arsenic and iron were only elevated in the sample collected in September 2007. In addition, concentrations of arsenic and iron in the filtered sample were significantly lower than those in the unfiltered sample. Concentrations of manganese were within site background levels.

Vapor Intrusion Evaluation for Groundwater

Groundwater data from Site 23 were evaluated to determine if there were unacceptable risks associated with vapor intrusion into buildings (Tetra Tech, 2008). Concentrations of volatile organic compounds (VOCs) in groundwater were compared to screening criteria for vapor intrusion. The screening criteria were obtained from USEPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002, CTDEP's Proposed Revisions - Connecticut's Remediation Standard Regulations Volatilization Criteria, March 2003, and USEPA Region I (April 24, 2008). Concentrations of chloroform and trichloroethene at Site 23 exceeded the USEPA screening criterion. These chemicals were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels at Site 23. Further evaluation against PRGs and ARARs showed that vapor intrusion is not an issue at Site 23. It was concluded that no further action was required for vapor intrusion issues at Site 23.

Conclusions

Historical and current information pertaining to Site 23 groundwater were reviewed to determine if Site 23 groundwater poses a threat to human health and the environment. The conclusions of this evaluation are the following:

- The HHRA performed during the BGOURI evaluated potential risks from exposures to groundwater by construction workers and hypothetical residents, although it is unlikely that direct contact exposures to Site 23 groundwater would occur based on current and expected future site use. Cumulative risks were less than or within USEPA and CTDEP acceptable levels. However, chemical-specific risks for tetrachloroethene exceeded the CTDEP target level for individual chemicals, although the maximum detected concentration of tetrachloroethene was less than its CTDEP RSR (5 μg/L). Concentrations of tetrachloroethene in Site 23 groundwater have decreased from 3 μg/L in the BGOURI to 0.3 J μg/L during the forth quarter of the underdrain meter pit sampling. Chemical-specific risks associated with tetrachloroethene would now be less than the CTDEP target level for individual chemicals.
- The HHRA guidance has been revised since the BGOURI HHRA was prepared but the changes in the guidance would not change the conclusions of the HHRA.
- Concentrations of chemicals in groundwater samples collected after the storm sewer rehabilitation were highest in samples collected in August and October, 2000 right after completion of construction and decreased significantly in subsequent sampling rounds.
- Concentrations of all chemicals detected in groundwater collected during the four quarters of the underdrain metering pit sampling were less than that CTDEP surface water protection and volatilization criteria with the exception of arsenic and several SVOCs. The concentration of total arsenic in the sample collected in September 2007 exceeded the surface water protection criteria although the concentration of arsenic in the filtered sample was less than the surface water protection criteria. The arsenic detected in the unfiltered sample is believed to be a result of suspended solid particles in the water and the filtered sample is more indicative of groundwater quality. Concentrations of acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, hexachlorobenzene, and phenanthrene exceeded the surface water protection criteria. These chemicals were not detected in the duplicate sample collected in December 2007 and these chemicals were not detected in the sample collected in February 2008.
- In general, concentrations of chemicals in Site 23 groundwater have decreased over time except as noted above.
- Potential risks for construction workers exposed to Site 23 groundwater are still acceptable using
 the analytical results from the four rounds of groundwater sampling. Potential risks for
 hypothetical residents exposed to Site 23 groundwater exceed acceptable levels, although Site
 23 is not suitable for residential development.
- The vapor intrusion evaluation for groundwater determined that risks from vapor intrusion were with USEPA and CTDEP acceptable levels for residential and industrial scenarios. The evaluation concluded that no further action was required for vapor intrusion issues at Site 23.

References

CTDEP (Connecticut Department of Environmental Protection), 2003. Proposed Revision, Connecticut's Remediation Standard Regulations, Volatilization Criteria. Bureau of Water Management, Permitting, Enforcement and Remediation Division, Hartford. Connecticut. March.

FWEC (Foster Wheeler Environmental Corporation), 2001. Final Closeout Report for Storm Sewer Rehabilitation, Naval Submarine Base New London, Groton, Connecticut, Langhorne, Pennsylvania. May.

Tetra Tech (Tetra Tech NUS, Inc.), 2002. Basewide Groundwater Operable Unit Remedial Investigation, Naval Submarine Base - New London, Groton, Connecticut. King of Prussia, Pennsylvania, January.

Tetra Tech, 2007. Letter Report for September 2007 Sampling Event, Site 23 Underdrain Metering, Naval Submarine Base – New London, Groton, Connecticut. Pittsburgh, Pennsylvania, October.

Tetra Tech, 2008. Vapor Intrusion Evaluation for Groundwater at Operable Unit (OU) 9, Naval Submarine Base – New London, Groton, Connecticut. Pittsburgh, Pennsylvania. May 14.

USEPA (United States Environmental Protection Agency), 2002. Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air. Office of Solid Waste and Emergency Response. EPA 530-F-02-052. November.

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R/99/005, Office of Emergency and Remedial Response, Washington, D.C., July.

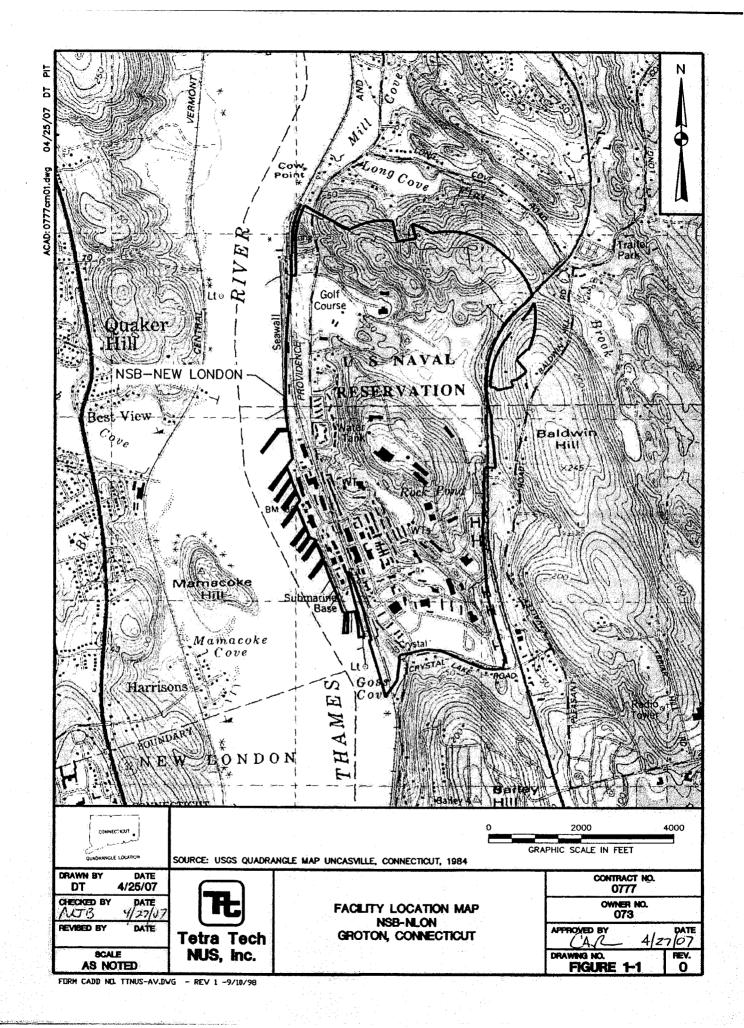
USEPA Region 9, 2004. Preliminary Remediation Goals, November.

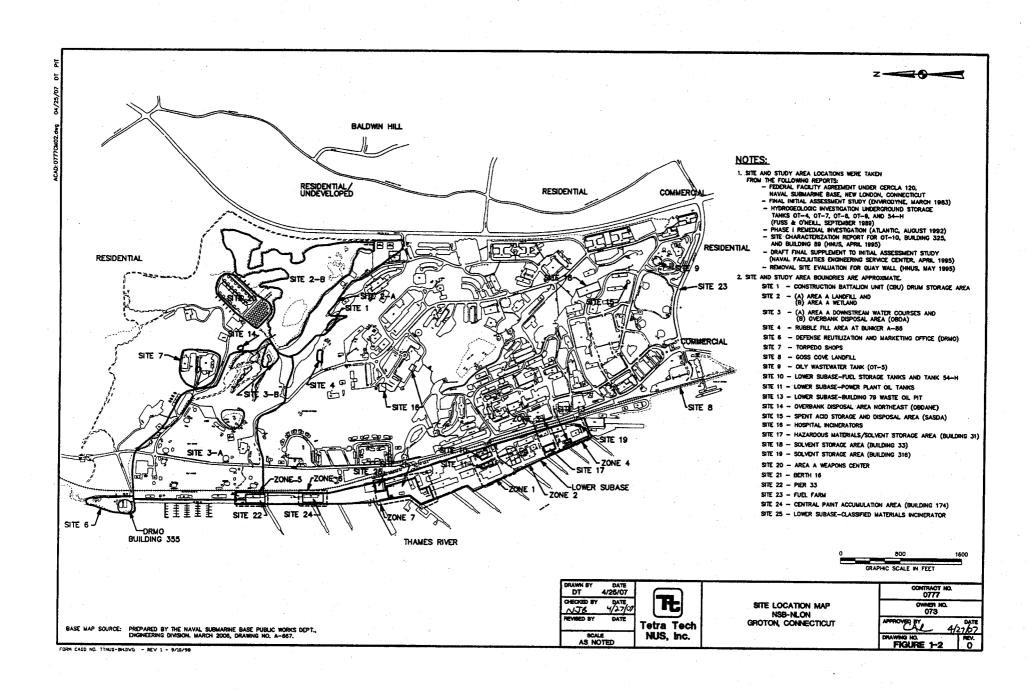
USEPA, 2005a. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001B. Risk Assessment Forum, Washington, DC. March.

USEPA, 2005b. Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R-03/003F. Risk Assessment Forum, Washington, DC. March.

USEPA Region I, 2008. EPA Comments on the Basewide Groundwater Vapor Intrusion Analyses. Email from Kymberlee Kecker of USEPA Region I to Corey Rich of Tetra Tech NUS, Inc. April 24.

FIGURES





ATTACHMENT A.1 TABLES FROM BASEWIDE GROUNDWATER OPERABLE UNIT REPORT

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 23 DIRECT CONTACT EXPOSURE SCENARIOS BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONNECTIC

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Tank Farm (Site 23)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-B COPC Sc Leve	reening	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Volatile Organics	W				,	- 0	0001/11/00004	1.5			T	1 24	N ⁽⁷⁾	530	ICTDEP RSR	NO	BSL
	M+P-XYLENES	2		2		ug/L	S23MW02S01	1/7	2	2	N/A	21	N	10000	FED-MCL CTDEP-MCL		BSL
95-47-6	O-XYLENE	3		3		ug/L	S23MW02S01	1/7	1	3	N/A	21	N ⁽⁷⁾	530 10000 10000	CTDEP RSR FED-MCL CTDEP-MCL		BSL
127-18-4	TETRACHLOROETHENE	3		3		ug/L	S23MW03D01	1/3	1	3	N/A	0.1	C	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL		ASL
1330-20-7	XYLENES, TOTAL	5		5		ug/L	S23MW02S01	1/7	1	5 -	N/A	21	N	530 10000 10000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
Dissolved Gases									<u></u>						T		
74-82-8	METHANE	1		920		ug/L	S23MW02S01	7/10	1	920	N/A	N/A		N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
Semivolatile Organ					,		***************************************				1 101				LOTDEO DOD	W.	ASL
91-20-3	NAPHTHALENE	1.4	ļ	1.4		ug/L	\$23MW02S01	1/7	0.5 - 5	1.4	N/A	0.62	N	280 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	130	ASL
Total Metals								····									
7429-90-5	ALUMINUM	890		2030		ug/L	\$23MW02S01	1/7	50.5 - 591	2030	3560	3600	N	N/A 50 to 200 N/A	FED-SMCL CTDEP-MCL	NO	EPAI, BKG
7440-38-2	ARSENIC	4.7		4.7		ug/L	S23HNUS1101	1/7	2.3	4.7	1.92	N/A		50 10 50	FED-MCL CTDEP-MCL	NO	BSL
7440-39-3	BARIUM	27.2		176		ug/L	S23MW02S01	1/7	18 - 37	176	227	730	. N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-43-9	CADMIUM	0.63		0.63		ug/L	\$23HNUS2001	4/7	0.25	0.63	ND	1.8	N	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-70-2	CALCIUM	6270		94100		ug/L	\$23MW03D01	10/10	N/A	94100	188000	, N/A		N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL		NUT, BKG
7440-47-3	CHROMIUM	10.2	J	43.2		ug/L	\$23MW02S01	4/10	6.2	43.2	49.9	11	N ⁽⁸⁾	50 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-48-4	COBALT	4.5	J	6.4	J	ug/L	\$23MW02S01,	4/10	4.2 - 5.2	6.4	48.6	73	Ņ	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	COPPER	6.8	J	10.7	J	ug/L	S23MW02S01	2/10	6.8	10.7	107	150	N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL		BSL, BKG
7439-89-6	IRON	202		24800		ug/L	S23MW02S01	9/10	175	24800	28200	2600	N ⁽¹⁰⁾	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI, BKG

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 23 DIRECT CONTACT EXPOSURE SCENARIOS BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTTON, CONNECTICUT PAGE 2 OF 3

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Tank Farm (Site 23)

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
7439-92-1	LEAD	1.9	J	31.2		ug/L	S23MW02S01	5/10	1.8	31.2	6.63	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	YES	ASL
7439-95-4	MAGNESIUM	1610		7840		ug/L	S23MW02S01	9/10	544	7840	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	MANGANESE	41.4	J	3380		ug/L	\$23MW02S01	8/10	8.8 - 12.1	3380	11700	88 N	N/A 50 N/A	FED-SMCL CTDEP-MCL	NO	BKG
7440-02-0	NICKEL	10	J	33.5		ug/L	S23MW02S01	2/10	9.2 - 9.9	33.5	32.2	73 N	100 100 100	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-09-7	POTASSIUM	1170		7790		ug/L	S23MW02S01	10/10	N/A	7790	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	SODIUM	7790	J	99200	J	ug/L	S23HNUS201	10/10	N/A	99200	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-62-2	VANADIÚM	6.4		6.4	J	ug/L	\$23MW03D01	1/10	6.3 - 8.2	6.4	10.2	3.6 N	50 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-66-6	ZINC	68.4		68.4		ug/L	S23MW02S01	1/10	10.9 - 43.1	68.4	131	1100 N	5000 5000 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL, BKG
Dissolved Metals	1.2															
7440-38-2	ARSENIC, FILTERED	3.1	J	3.1	J	ug/L	S23MW02S01-F	1/2	2.3	3.1	2,55	. N/A	50 10 50	FED-MCL CTDEP-MCL	NO	BSL
7440-39-3	BARIUM, FILTERED	33.8		150		ug/L	S23MW02S01-F	2/2	N/A	150	124	260 N	1000 2000 2000	FED-MCL CTDEP-MCL	NO	BSL
7440-70-2	CALCIUM, FILTERED	33000		45100		ug/L	\$23MW02S01-F	2/2	N/A	45100	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	IRON, FILTERED	4410		15400	·	ug/L	S23MW02S01-F	2/2	N/A	15400	25300	2600 N ⁽¹⁰⁾	N/A 590 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI, BKG
7439-92-1	LEAD, FILTERED	10		10		ug/L	S23MW02S01-F	1/2	1.8	10	2.52	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO.	BSL
7439-95-4	MAGNESIUM, FILTERED	3770		5830		ug/L	S23MW02S01-F	2/2	N/A	5830	150000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-96-5	MANGANESE, FILTERED	977		2650		ug/L	S23MW02S01-F	2/2	N/A	2650	9400	88 N	N/A . 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	POTASSIUM, FILTERED	5500		7340		ug/L	S23MW02S01-F	2/2	N/A	7340	60000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	SODIUM, FILTERED	49300		82600	J	ug/L	S23HNUS201-F	2/2	N/A	82600	1580000	N/A	N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 23 DIRECT CONTACT EXPOSURE SCENARIOS BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONNECTICUT PAGE 3 OF 3

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Tank Farm (Site 23)

CAS Number	Chemical	Minimum Concentration	Minimum Qualifler	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Miscellaneous Para															<u>,</u>	
E-14506	ALKALINITY	18		348		mg/L	S23MW03D01	10/10	N/A	348	1950	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL		BKG
7664-41-7	AMMONIA	0.16	J	0.54	J	mg/L	S23HNUS201	3/3	N/A	0.54	ND	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL		NTX
7664-41-7	AMMONIA, AS NITROGEN	0.13	J	6.9	J	mg/L	S23MW02S01	6/7	100	6.9	ND	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL	1	NTX
000-02-0	CHLORIDE	6.55		124		mg/L	\$23MW02\$01	10/10	N/A	124	4540	N/A	250	CTDEP RSR FED-SMCL CTDEP-MCL		BSL
E-11778	HARDNESS as CaÇO3	22.3		257		mg/L	S23MW03D01	10/10	N/A	257	ND	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL		NTX
14808-79-8	SULFATE	7.6		47.2		mg/L	S23HNUS2001	10/10	N/A	47.2	45.2	N/A	250	CTDEP RSR FED-SMCL CTDEP-MCL		BSL
000-09-0	TOTAL DISSOLVED SOLIDS	66.2		519	J	mg/L	S23MW02S01	10/10	N/A	519	6260	N/A	500	CTDEP RSR FED-SMCL CTDEP-MCL	' '	BKG
7440-44-0	TOTAL ORGANIC CARBON	1	J	9		mg/L	S23MW04S01	10/10	N/A	9	37.7	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL		BKG
000-08-9	TOTAL SUSPENDED SOLIDS	6	j	169	J	mg/L	S23MW02S01	6/10	5000	169	236	N/A	N/A	CTDEP RSR FED-MCL CTDEP-MCL		8KG

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data .
- 5 The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (USEPA, Region IX, October 2004, Update December 28, 2004).

S23MW04S01

- 6 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- Value is for total xylenes.
- 8 Value is for hexavalent chromium.

Associated	Sam	ole

S23HNUS1101 S23MW02D01 S23HNUS1301

S23MW02D01-D

S23HNUS2001 S23MW02S01 S23MW02S01-F S23HNUS201

S23HNUS201-F S23HNUS501

S23MW03D01 S23MW04D01

<u>Definitions:</u>

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COC = Chemical of Concern

J = Estimated Value

N ≈ Noncarcinogen. N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (USEPA, August 2000).

FED-SMCL = Federal Secondary Maximum Contaminant Level (USEPA, August 2000).

FED-AL = Federal Action Level (USEPA, August 2000)

CTDEP-RSR = Connecticut DEP Remediation Standard Regulations, 1996.

CTDEP-MCL = Connecticut Maximum Contaminant Level.

Rationale Codes:

For Selection as a COC:

ASL = Above COC Screening Level/ARAR/TBC.

For Elimination as a COC:

8KG = Within Background Levels.

BSL = Below COC Screening Level/ARAR/TBC

NUT = Essential Nutrient.

NTX = No Toxicity Information.

EPAI = USEPA Region 1 does not advocate evaluation of this chemical.

NV = Miscellaneous parameters are not evaluated in human health risk assessments.

OCCURRENCE, DISTRIBUITON, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 23 MIGRATION PATHWAYS BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater
Exposure Point: Tank Farm (Site 23)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or
Volatile Organics								·		L	L		1	Li	Selection ⁽⁶⁾
95-47-6	M+P-XYLENES	2		2		ug/L	S23MW02S01	1/10	2	2	NA.	I NA	21300	NO	
127-18-4	O-XYLENE	3		3		ug/L	S23MW02S01	1/10	1 1	3	NA NA	NA NA	21300		BSL
1330-20-7	TETRACHLOROETHENE	3		3		ug/L	S23MW03D01	1/10	1 1	3	NA NA	88	1500	NO	BSL
	XYLENES, TOTAL	5		5		ug/L	S23MW02S01	1/10	1	5	NA NA	NA NA	21300	NO	BSL
Dissolved Gases 74-82-8	In the second se							1	· · · · · · · · · · · · · · · · · · ·	<u> </u>	INA	I NA	21300	NO	BSL
	METHANE	1		920		ug/L	S23MW02S01	7/10	1	920	NA NA	N/A	N/A	NO	NEW
Semivolatile Organ								1	<u> </u>	320	I INA	IN/A	N/A	NO	NTX
91-20-3	NAPHTHALENE	1.4		1.4		ug/L	S23MW02S01	1/10	0.5 - 5	1.4	NA	N/A	N/A	NO	11971
Total Metals 7429-90-5								17.15		1.7	1474	IN/A	IN/A	NO	NTX
7449-90-5 7440-38-2	ALUMINUM	890		2030		ug/L	S23MW02S01	2/10	50.5 - 591	2030	3560	N/A	N/A	NO	BKG
7440-38-2 7440-39-3	ARSENIC	4.7		4.7		ug/L	S23HNUS1101	1/10	2.3	4.7	1.92	A A	N/A		
7440-39-3 7440-43-9	BARIUM	27.2		176		ug/L	S23MW02S01	4/10	18 - 37	176	227	N/A	N/A N/A	YES	ASL
7440-43-9	CADMIUM	0.63		0.63		ug/L	S23HNUS2001	1/10	0.25	0.63	ND	6	N/A N/A	NO	BKG BSL
	CALCIUM	6270		94100		ug/L	\$23MW03D01	10/10	N/A	94100	188000	N/A		NO	
7440-47-3	CHROMIUM	10.2	J	43.2		ug/L	S23MW02S01	4/10	6.2	43.2	49.9	N/A	N/A N/A	NO	BKG
7440-48-4	COBALT	4.5	J	6.4	J	ug/L	S23MW02S01.	4/10	4.2 - 5.2	6.4	48.6	N/A		NO	BKG
7440-50-8	COPPER	6.8	J	10.7	J	ug/L	S23MW02S01	2/10	6.8	10.7	107	48	N/A	NO	BKG
7439-89-6	IRON	202		24800		ug/L	S23MW02S01	9/10	175	24800	28200	N/A	N/A	NO	BSL, BKG
7439-92-1	LEAD	1.9	J	31.2		ug/L	S23MW02S01	5/10	1.8	31.2	6.63	13	N/A	NO	BKG
7439-95-4	MAGNESIUM	1610		7840		ug/L	S23MW02S01	9/10	544	7840	191000		N/A	YES	ASL
7439-96-5	MANGANESE	41.4	J	3380		ug/L	S23MW02S01	8/10	8.8 - 12.1	3380	11700	N/A N/A	N/A	NO	BKG
7440-02-0	NICKEL	10	J	33.5		ua/L	S23MW02S01	2/10	9.2 - 9.9	33.5	32.2	880	N/A	NO	BKG
440-09-7	POTASSIUM	1170		7790		uo/L	S23MW02S01	10/10	N/A	7790	70800	N/A	N/A	NO	BSL
440-23-5	SODIUM	7790	J	99200	J	ug/L	S23HNUS201	10/10	N/A	99200	1900000		N/A	NO	BKG
440-62-2	VANADIUM	6.4	J	6.4	J	ug/L	S23MW03D01	1/10	6.3 - 8.2	6,4		N/A N/A	N/A	NO	BKG
440-66-6	ZINC	68.4		68.4		ua/L	\$23MW02S01	1/10	10.9 - 43.1	68.4	10.2		N/A	NO	BKG
Dissolved Metals								1110	10.5 - 45.1	00.4	131	123	N/A	NO	BSL, BKG
440-38-2	ARSENIC, FILTERED	3.1	J	3.1	J	ug/L	S23MW02S01-F	1/2	2.3	3.1	2.55	4			
440-39-3	BARIUM, FILTERED	33.8		150		ug/L	S23MW02S01-F	2/2	N/A	150	124	N/A	N/A	NO	BSL
440-70-2	CALCIUM, FILTERED	33000		45100		ua/L	S23MW02S01-F	2/2	N/A	45100	152000		N/A	NO	NTX
439-89-6	IRON, FILTERED	4410		15400		ug/L	S23MW02S01-F	2/2	N/A	15400	25300	N/A	N/A	NO	BKG
439-92-1	LEAD, FILTERED	10		10		ua/L	S23MW02S01-F	1/2	1.8	10	2.52	N/A	N/A	NO	BKG
439-95-4	MAGNESIUM, FILTERED	3770		5830		ug/L	S23MW02S01-F	2/2	N/A	5830		13	N/A	NO	BSL
439-96-5	MANGANESE, FILTERED	977		2650		ug/L	S23MW02S01-F	2/2	N/A	2650	150000	N/A	N/A	NO	BKG
440-09-7	POTASSIUM, FILTERED	5500		7340		ug/L	\$23MW02S01-F	2/2	N/A	7340	9400	N/A	N/A	NO	BKG
440-23-5	SODIUM, FILTERED	49300		82600	J.	ug/L	S23HNUS201-F	2/2	N/A		60000	N/A	N/A	NO	BKG
liscellaneous Para						-gre	OZOI INOOZO I-P	2/2	N/A	82600	1580000	N/A	N/A	NO	BKG
-14506	ALKALINITY	18	Т	348		mg/L	S23MW03D01	10/10	N/A	240	1050				
664-41-7	AMMONIA	0.16	J	0.54		ma/L	S23HNUS201	3/3	N/A N/A	348	1950	N/A	N/A	NO	BKG
664-41-7	AMMONIA, AS NITROGEN	0.13	j	6.9		mg/L	S23MW02S01	6/7	100	0.54	ND	N/A	N/A	NO	NTX
00-02-0	CHLORIDE	6.55		124		ma/L	S23MW02S01	10/10		6.9	ND	N/A	N/A	NO	NTX
		· · · · · · · · · · · · · · · · · · ·		127		mg/L	JZJIVIVVUZJU I	10/10	N/A	124	4540	N/A	N/A	NO	BKG

OCCURRENCE, DISTRIBUITON, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 23 MIGRATION PATHWAYS

BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Tank Farm (Site 23)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency		Concentration Used for Screening ⁽³⁾		CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
E-11778	HARDNESS as CaCO3	22.3		257		mg/L	S23MW03D01	10/10	N/A	257	ND	N/A	N/A	NO	NTX
14808-79-8	SULFATE	7.6		47.2		mg/L	S23HNUS2001	10/10	N/A	47.2	45.2	N/A	N/A	NO	NTX
000-09-0	TOTAL DISSOLVED SOLIDS	66.2		519	J	mg/L	S23MW02S01	10/10	N/A	519	6260	N/A	N/A	NO	BKG
7440-44-0	TOTAL ORGANIC CARBON	1	J	9		mg/L	S23MW04S01	10/10	N/A	9	37.7	N/A	N/A	NO	BKG
000-08-9	TOTAL SUSPENDED SOLIDS	6	J	169	J ·	mg/L	S23MW02S01	6/10	5000	169	236	N/A	N/A	NO	BKG

A shaded value indicates that the concentration used for screening exceeds the criterion or background value. A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes

1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.

S23MW04S01

- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 95% Upper Tolerance Limit (UTL) of site background data.
- 5 Connecticut DEP Surface Water Protection criteria.
- 6 Connecticut DEP Volatilization criteria for residential exposures.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the CTDEP surface water protection or volatilization criteria.

Associated Samples:

\$23HNUS1101 \$23HW02D01 \$23HNUS1301 \$23HW02D01-D \$23HNUS2001 \$23HW02S01 \$23HNUS201 \$23HNUS201-F \$23HNUS201-F \$23HNUS501 \$23HW04D01

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered. C = Carcinogen.

COC = Chemical of Concern.

J = Estimated Value.

N ≈ Noncarcinogen.

NA = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Within Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 23 REASONABLE MAXIMUM EXPOSURES

BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONNECTICUT

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	1.3E-09		••		0.0002	
		-						
Adult Resident	Groundwater	Ingestion	1.8E-06	••	••	Tetrachloroethene	0.01	
	1	Dermal Contact	8.5E-07	• •		• •	0.005	
		Inhalation (1)	1.8E-06	••	• •	Tetrachloroethene	0.008	
		Total	4.5E-06			Tetrachloroethene	0.02	

Notes:

^{1 -} Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

ATTACHMENT A.2
TABLES FROM STORM SEWER REHABILITATION

TABLE 1

GROTON STORM SEWER REHABILITATION PROJECT

UNDERDRAIN WATER SAMPLING FOR OIL/WATER SEPARATOR (OWS) DETERMINATION

MONTHLY SAMPLING RESULTS

	Sample #	OWS-072500	OWS-082300	OW\$-100400	ows	-011701	OWS	-031501	OWE	-041901	0.446	050004	0.5000	
	Date sampled	7/25/2000	8/23/2000	10/4/2000	1/1	7/2001	3/1	5/2001	4/1	9/2001	5/2	-052301 3/2001	CTDEP RSR Surface Water Protection	Groundwater
A PANALYSIS (20-2)	MENHOD I	RESULTS	RESULTS	RESULTS	RES	ULTS	RE	SUETS	DE .	July 18	DE C	SULTS	Criteria(1)	Volatilization Criteria ⁽²⁾
Fuel Type Fingerprint	8015	ND	ND	ND		NA ·		NA		E	A CONTRACTOR OF THE			
PH	EPA 150.1	6.2 std. Units	6.3 std. Units	6.3 std. Units		NA		NA		23	·	E	NA NA	NA
Total petroleum	4. *						<u> </u>				 	5.64	NA NA	NA
hydrocarbons	418.1	1.1 mg/l	<1.0 mg/l	1.0 mg/l		NA.	i	NA			[
Oil and grease	EPA 413.1	<5.0 mg/l	<5.0 mg/l	<5.0 mg/l		NA		NA NA	5.2	mg/l		8 mg/l	NA NA	NA NA
Total suspended solids	EPA 160.2	62 mg/l	700 4						9.2	mg/i	16	mg/l	NA NA	NA
Metals:	6010B		720 mg/l	1400 mg/l	<5.0) mg/l	23	mg/l	160	mg/i	27	3 mg/l	NA	NA
	00108	NA .	ug/I	ug/l		ıg/l		ıg/l		ıg/l		Jq/l		9/1
Aluminum		NA NA			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	u	9"
Antimony		NA NA	11300	15500	1360	492	1670	ND	2150	16.5 B	2540	ND ND		
Arsenic		NA NA	6.4 13.4	4.1	ND	. ND	ND	ND	ND	ND	3.28	ND .	86000	NA NA
Barium		NA NA	169	22.2	ND	ND	5.6 B	ND	8.1 B	2.8 B	9.1B	ND	4	NA NA
Beryllium		NA NA		223	64.5 B	56.3 B	61.6 B	33.4 B	82.7 B	45.3 B	96,7B	38.38	NA NA	NA NA
Cadmium		NA NA	2.6	0.3	ND	1.7 B	ND	ND	0.15 B	ND	0.988	0.80B	4	NA NA
Calcium		NA NA	0.8	0.8	ND	ND	ND	ND	ND	ND	ND	ND ND	6	NA NA
Chromium		NA NA	32500	35800	31100	29700	35400	31300	36600	33200	28200	28600	NA NA	NA NA
Cobalt			19.6	28.4	2.2 B	ND	2.4 B	ND	4.0 B	ND	6.5B	ND ND	110	NA NA
Copper		NA NA	9.9	17	2.4 B	ND	1.6 B	ND	3.2 B	ND	4.48	ND ND	NA NA	NA NA
Iron		NA NA	36	39.5	ND	ND	6.1 B	ND	4.1 B	ND	10.6B	3.3B	48	
Lead		NA NA	62100	116000	15100	11100	24100	76.6 B	32600	258	62500	125	NA NA	NA NA
Magnesium		NA	79.7	93.7	13.2	7.9	11.1	ND	16.7	ND	28.5	ND ND	13	NA NA
Manganese		NA .	9950	12000	7350	6560	8350	6850	8950	7560	6620	6400	NA NA	NA NA
Mercury		NA NA	1540	2220	884	801	896	582	1150	515	1630	476	NA NA	
Nickel		NA NA	0.1	0.2	ND	ND	ND	ND	ND	ND	ND	0.25	0.4	NA NA
Potassium		NA NA	13.2	18.3	ND	ND	ND	3.3 B	ND	ND	ND	ND ND	880	NA NA
Selenium		NA	8600	9060	5430	5100	7100	4770 B	6400	5090	42708	4330B		NA NA
Silver		NA NA	2.2	12.5	ND	ND	ND	ND	ND	ND	5.4	ND ND	NA 50	NA
Sodium		NA NA	2.8	4	ND	ND	ND	ND	ND	ND	1.9B	ND ND		NA
Thailium		NA NA	39500	51800	41800	37500	46100	39700	48400	44700	40400	45400	12 NA	NA
Vanadium		NA	3.2	3.2	ND	ND .	ND	ND	ND	ND ND	ND ND	3.9B	63	NA NA
Zinc		NA NA	40.5	52.7	4.0 B	ND	8.7 B	ND	ND	ND	ND ND	ND ND	NA NA	NA
		NA NA	228	231	53.5	43.5	48.5	7.0 B	58.1	23.1	87.9	44.0		NA
Cyanide VOA		NA NA	NR	NR	NA	NA ·	NA	NA NA	NA NA	NA NA	NA NA	NA NA	123	NA
Tetrachioroethene	OLM2.1										NA .	L NA	NA	NA NA
VOA (TIC)					. N	D	N	D	. N	n		5J		
	OLM2.1										<u> </u>	55	88	340
Methane, chlorodifluoro-					4,0	J	N	D	N	0		0	N/A	
Ethane, 1,1,2-trichloro-1,2,	20700				2.9	J	N		8.5		1.		NA NA	NA NA
	8270C						······································				<u></u> !:	1.3	NA NA	NA
Dimethylphthalate Diethylphthalate					N		N	D .	N	<u> </u>			NA	
					N		N		N N		1		NA NA	NA
Di-n-butylphthalate					N		N		n N					NA NA
Bis(2-Ethylhexyl)phthalate					N	0	N		N N		2		NA SO	NA
	8310								14			·	59	NA NA
Naphthalene					N	D	N	D	N	n —	0.3	171	- NA	
henanthrene					8.0	00	N		N		0.3		NA NA	NA NA
luoranthene					3.0	00	N		N		0.:		0.3	NA NA
yrene					N	D 1	N		N		0.		3700	NA
enzo(a)anthracene					N		N		N N		0.2		110000	NA
hrysene					N		N		N				0.3	NA
enzo(b)fluoranthene					NI		N		N		0.2 0.4		NA NA	NA
enzo(k)fluoranthene					N	5	N		N				0.3	NA
enzo(a)pyrene		·			N	5	Ni Ni		NI NI		2.0		0.3	NA
Dibenzo(a,h)anthracene					N		N		NI NI		0.0		NA NA	NA
lenzo(ghi)perylene					N		NI NI		NI NI		0.6		NA NA	NA NA

Notes: ND = Not Detected NA = Not Analyzed

NR = Not reported

NR = Not reported

J = Indicates an estimated value

B = Indicates the analyte was found in the blank as well as the sample

E = No Calibrated Fuel Type Detected

Pesticide/PCB compounds were not detected (Method OLM2.1)

1 - CTDEP Remediation Standard Regulations, Residential, 1996.

2 - Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, March 2003. Shading indicates that concentration exceeds the screening criteria.

ATTACHMENT A.3 RISKS BASED ON STORM SEWER REHABILIATION GROUNDWATER ANALYTICAL SAMPLING RESULTS

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Workers	Adult	Site 23	i	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermally Absorbed Dose (mg/kg/day) =
				SA	Skin Surface Available for Contact	3300	cm2	U.S. EPA, 2004	(g,g,.cay)
				EV	Event Frequency	1	events/day	(1)	DAevent x EV x EF x ED x SA
·		İ		ET	Exposure Time	4	hours/day	(1)	BW x AT
				EF .	Exposure Frequency	30	days/year	(1)	200.200
				ED	Exposure Duration	1	years		See text for calculation of DAevent.
				BW	Body Weight	70	kg	U.S. EPA, 1989	To tok for dalidation of BASVETIL
. [AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
ces:				AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1; Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion Intake = (IR-GW x EF x ED)/(BW x AT) Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake = NA

Cancer Dermal Intake = 5.54E-02

Noncancer Ingestion Intake = NA

Noncancer Dermal Intake = 3.87E+00

^{1 -} Professional judgment.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Construction Workers	Adult	Site 23	CA	Chemical concentration in air	Calculated	mg/m3	VDEQ, 2004	intake (mg/kg/day) =
				cw	Chemical concentration in water.	Average	ug/L		
				CF	Conversion Factor	0.001	mg/ug	-	CA x IR x ET x EF x ED
				· IR	Inhalation Rate	2.5	m3/hour	U.S. EPA, 1993	BW x AT
				ET	Exposure Time	4	hours/day	(1)	
				EF	Exposure Frequency	30	days/year	(1)	CA = CW x CF x VF
				ED	Exposure Duration	1	years	(1)	
				BW	Body Weight	70	kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	
				VF	Volatilization Factor	Calculated	(mg/m3)/(mg/L)	VDEQ, 2004	

Notes:

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

VDEQ, 2004; Virginia Department of Environmental Quality (VDEQ, online- http://www.deq.state.va.us/vrprisk/homepage.html).

Unit Intake Calculations

Inhalation intake = (IR x ET x EF x ED)/(BW x AT)

Cancer Inhalation Intake = 1.68E-04

Noncancer Inhalation Intake = 1.17E-02

^{1 -} Professional judgment.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Child	Site 23	cgw	Chemical Concentration in Groundwater	Max or 95% UCL	mg/kg	U.S. EPA, 2002a	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug		- mana bany mana (bany mg/ady) -
				IR-GW	Ingestion Rate of Groundwater	1.5	L/day	U.S. EPA, 1994	CW x CF x IR-GW x EF x ED
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	BW x AT
			. *	ED1	Exposure Duration (Age 0 - 2)	2	years	U.S. EPA, 1989	
	•	7.		ED2	Exposure Duration (Age 2 - 6)	4	years	U.S. EPA, 1989	
				8W	Body Weight	15	kg	U.S. EPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
······································		· · · · · · · · · · · · · · · · · · ·		AT-N	Averaging Time (Non-Cancer)	2190	days	U.S. EPA, 1989	
Dermal	Residents	Child	Site 23	Daevent	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermaily Absorbed Dose (mg/kg/day) =
		* -		SA	Skin Surface Available for Contact	6,600	cm2	U.S. EPA, 2004	, , , ,
				EV	Event Frequency	1	events/day	U.S. EPA, 2004	DAevent x EV x EF x ED x SA
	·			ET	Exposure Time	0.25	hours/day	U.S. EPA, 1997	BW x AT
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	
				ED1	Exposure Duration (Age 0 - 2)	2	years	U.S. EPA, 1989	See text for calculation of DAevent.
				ED2	Exposure Duration (Age 2 - 6)	4	years	U.S. EPA, 1989	
				8W	Body Weight	15	kg	U.S. EPA, 1991	
			'	AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	U.S. EPA, 1989	

- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 1991: Risk Assessment Guidance for Superfund Supplemental Guidance- Standard Default Exposure Factors Interim Final.
- U.S. EPA, 1994; U.S. EPA Region I Risk Updates, August 1994.
- U.S. EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa
- U.S. EPA, 2002:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.
- U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion Intake = (IR-GW x EF x ED)/(BW x AT) Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake (Age 0 - 2) ≈ 2.74E-06 Cancer Ingestion Intake (Age 2 - 6) = 5.48E-06

Cancer Dermal Intake (Age 0 - 2) = 1.21E+01 Cancer Dermai Intake (Age 2 - 6) = 2.41E+01

Noncancer Ingestion Intake = 9.59E-05

Noncancer Dermal Intake.≈ 4.22E+02

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Adult	Site 23	cgw	Chemical Concentration in Groundwater	95% UCL or Max	ug/L	U.S. EPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
* - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -				CF	Conversion Factor	0.001	mg/ug	<u>-</u>	
				IR-GW	Ingestion Rate of Groundwater	2	L/day	U.S. EPA, 1994	CW x CF x IR-GW x EF x ED
				EF.	Exposure Frequency	350	days/year	U.S. EPA, 1994	. BW x AT
				ED1	Exposure Duration (Age 10 - 16)	10	years	U.S. EPA, 1989	
				ED2	Exposure Duration (Age 16 - 30)	-14	years	U.S. EPA, 1989	
	,			вw	Body Weight	70	kg	U.S. EPA, 1989	· .
				AT-C	Averaging Time (Cancer)	25,550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,650	days	U.S. EPA, 1989	
Dermal	Residents	Adult	Site 23	Daevent	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermally Absorbed Dose (mg/kg/day) =
				SA .	Skin Surface Available for Contact	18,000	cm2	U.S. EPA, 2004	
				ĒV	Event Frequency	1	events/day	U.S. EPA, 2004	DAevent x EV x EF x ED x SA
				ET	Exposure Time	0.25	hours/day	U.S. EPA, 2004	BW x AT
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	
				ED1	Exposure Duration (Age 10 - 16)	10	years	U.S. EPA, 1989	See text for calculation of DAevent.
			,	ED2	Exposure Duration (Age 16 - 30)	14	years	U.S. EPA, 1989	
				BW	Body Weight	70	kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25,550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,650	days	U.S. EPA, 1989	

Sources:

- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 1991: Risk Assessment Guidance for Superfund Supplemental Guidance- Standard Default Exposure Factors Interim Final.
- U.S. EPA, 1994: U.S. EPA Region I Risk Updates, August 1994.
- U.S. EPA, 1997: Exposure Factors Handbook, U.S. EPA/600/8-95/002FA.
- U.S. EPA, 2002; Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.
- U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion Intake = (IR-GW x EF x ED)/(BW x AT)

Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake Age 10 - 16) = 3.91E-06

Cancer Dermal Intake Age 10 - 16) = 3.52E+01

Cancer Ingestion Intake Age 16 - 30) = 5,48E-06

Cancer Dermal Intake (Age 16 - 30) = 4.93E+01

Noncancer Ingestion Intake = 6.58E-05

Noncancer Dermal Intake = 5.92E+02

TABLE 4.5 INTERMEDIATE VARIABLES FOR CALCULATING DA(EVENT) SITE 23 - STORM SEWER NSB-NLON, GROTON, CONNECTICUT

Chemical of	Media	Dermal Absorption	FA	I	Кр	T/e	vent)	T 7	au	T	T*	
Potential Concern		Fraction (soil)	Value	Value	Units	Value	Units	Value	Units	Value	Units	B
Volatile Organic Compounds	3						1 0	Value	Olits	value	Units	Value
Tetrachloroethene	Groundwater	NA	1	3.3E-02	cm/hr	4	hr	9.1E-01	hr	2.2E+00	hr	1.7E-01
Semivolatile Organic Compo							<u> </u>	1 0.12 01	1	2.22+00	1	1.7E-01
Benzo(a)anthracene(1)	Groundwater	NA	NA	NA	NA	NA.	I NA	NA.	l NA	NA NA	T NA	NA NA
Benzo(a)pyrene ⁽¹⁾	Groundwater	NA	NA	NA.	NA	NA	NA	NA NA	NA.	NA NA	NA NA	·
Benzo(b)fluoranthene ⁽¹⁾	Groundwater	NA	NA	NA	NA	NA	NA.	NA NA	NA NA	NA NA		NA NA
Benzo(g,h,i)perylene ⁽¹⁾	Groundwater	NA	NA	NA	NA	NA.	NA NA	NA NA	NA NA		NA NA	NA NA
Benzo(k)fluoranthene(1)	Groundwater	NA NA	NA	NA	NA	NA.	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
Bis(2-Ethylhexyl)phthalate	Groundwater	NA	0.8	2.5E-02	cm/hr	4	hr	1.7E+01		NA 4.0504	NA .	NA NA
Chrysene ⁽¹⁾	Groundwater	NA NA	NA	NA NA	NA NA	NA NA	NA NA		hr NA	4.0E+01	hr	1.9E-01
Dibenzo(a,h)anthracene(1)	Groundwater	NA I	NA	NA NA	NA NA	NA NA	NA NA	NA NA		NA NA	NA	NA.
Diethylphthalate	Groundwater	NA NA	1	3.9E-03	cm/hr	4		NA 105 00	NA	NA .	NA:	NA
Dimethylphthalate	Groundwater	NA NA	1	1.4E-03	cm/hr	4	hr h-	1.9E+00	hr	4.5E+00	hr	2.2E-02
Di-n-butylphthalate	Groundwater	NA NA	0.9	2.4E-02	cm/hr	4	hr hr	1.3E+00	hr	3.1E+00	hr	7.4E-03
Fluoranthene ⁽¹⁾	Groundwater	NA NA	NA	NA	NA	NA NA		3.9E+00	hr	9.3E+00	hr	1.5E-01
Naphthalene	Groundwater	NA NA	1	4.7E-02	cm/hr	4	NA i	NA .	NA	NA	NA	NA
Phenanthrene ⁽¹⁾	Groundwater	NA	NA	NA NA	NA NA	NA	hr	5.6E-01	hr	1.3E+00	hr	2.0E-01
Pyrene	Groundwater	NA NA	1	1.9E-01	cm/hr	1NA 4	NA NA	NA 1.15-00	NA NA	NA	NA NA	NA
Inorganics		1,77		1.02-01	CITI/III	4	hr	1.4E+00	hr	5.5E+00	hr	1.1E+00
Aluminum	Groundwater	l NA I	1	1.0E-03	cm/hr	4	b.					
Antimony	Groundwater	NA NA		1.0E-03	cm/hr	4	hr hr	NA NA	NA NA	NA	NA	NA
Arsenic	Groundwater	NA NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA NA	NA NA	NA	NA
Barium	Groundwater	NA NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA NA	NA	NA	NA NA
Beryllium	Groundwater	NA	1	1.0E-03	cm/hr		hr	NA NA	NA NA	NA NA	NA	NA
Chromium	Groundwater	NA .	1	2.0E-03	cm/hr		hr	NA NA	NA NA	NA NA	NA NA	NA
Cobalt	Groundwater	NA NA	1	1.0E-03	cm/hr		hr	NA NA	NA NA		NA	NA
Copper	Groundwater	NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA.	NA NA	NA	NA
ron	Groundwater	NA NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA.	NA NA	NA NA	NA
Manganese	Groundwater	NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA NA	NA NA	NA.	NA NA
Selenium	Groundwater	NA	1	1.0E-03	cm/hr	4	hr	NA NA	NA NA	NA NA	NA NA	NA
Silver	Groundwater	NA	1	6.0E-04	cm/hr	4	hr	NA NA	NA NA	NA NA	NA NA	NA NA
Zinc	Groundwater	NA NA	1	6.0E-04	cm/hr	4	br	NA I	NA NA	NA NA	NA NA	NA
Notes:							141	17/7	INA	INA	IVA .	NA

All values from EPA's Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, July 2004. 1 - RAGS Part E recommends that dermal exposures to PAHs in water should not be quantitatively evaluated in the risk assessment.

FA = Fraction Absorbed Water

Kp = Dermal Permeability Coefficient of Compound in Water

T(event) = Event Duration

Tau = Lag Time

T* = Time to Reach Steady-State

B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis NA = Not applicable.

TABLE 5.1 NON-CANCER TOXICITY DATA -- ORAL/DERMAL SITE 23 - STORM SEWER NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Chronic/ Subchronic		al RfD	Oral Absorption Efficiency	Absorbed Rf	D for Dermal ⁽²⁾	Primary Target	Combined Uncertainty/Modifying		et Organ(s)
Concern		Value	Units	for Dermal ⁽¹⁾	Value	Units	Organ(s)	Factors	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds										
Tetrachloroethene	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000/1	IRS	4/23/2008
Semivolatile Organic Compo	unds									
Benzo(a)anthracene	NA	NA	NA	NA .	NA	NA	NA NA	NA NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA NA	NA NA	NA NA	NA NA
Benzo(b)fluoranthene	NA	NA	NA NA	NA NA	NA	NA NA	NA NA	NA NA	NA	NA
Benzo(g,h,i)perylene ⁽³⁾	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	4/23/2008
Benzo(k)fluoranthene	NA NA	NA	NA NA	NA NA	NA	NA	NA .	NA	NA	NA
Bis(2-ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000/1	IRIS	4/23/2008
Chrysene	NA NA	NA	NA	NA NA	NA	NA	NA	NA NA	NA	NA
Dibenzo(a,h)anthracene	NA NA	NA	NA	NA NA	NA	NA	NA	NA NA	NA	NA
Diethylphthalate	Chronic	8.0E-01	mg/kg/day	1	8.0E-01	mg/kg/day	Body Weight	1000/1	IRIS	4/23/2008
Dimethylphthalate	NA	NA.	NA	NA NA	NA	NA	NA NA	NA NA	NA	NA
Di-n-butylphthalate	Chronic	1.0E-01	mg/kg/day	1	1.0E-01	mg/kg/day	Mortality	1000/1	IRIS	4/23/2008
Fluoranthene	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	Liver	3000/1	IRIS	4/23/2008
Naphthalene	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Body Weight	3000/1	IRIS	4/23/2008
Phenanthrene ⁽³⁾	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	4/23/2008
Pyrene	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	4/23/2008
Inorganics					· · · · · · · · · · · · · · · · · · ·					
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	PPRTV	10/23/2006
Antimony	Chronic	4.0E-04	mg/kg/day	0.15	6.0E-05	mg/kg/day	Blood	1000/1	IRIS	4/23/2008
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRIS	4/23/2008
Barium	Chronic	2.0E-01	mg/kg/day	0.07	1.4E-02	mg/kg/day	Kidney	300/1	IRIS	4/23/2008
Beryllium	Chronic	2.0E-03	mg/kg/day	0.007	1.4E-05	mg/kg/day	GS	300/1	IRIS	4/23/2008
Chromium	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	Fetotoxicity, GS, Bone	300/3	IRIS	4/23/2008
Cobalt	NA NA	NA	NA NA	NA	NA:	NA NA	NA NA	NA NA	NA	NA
Copper	Chronic	4.0E-02	mg/kg/day	1 1	4.0E-02	mg/kg/day	GS	NA .	HEAST	7/1997
iron	Chronic	7.0E-01	mg/kg/day	1	7.0E-01	mg/kg/day	GS	1.5	PPRTV	9/11/2006
Manganese	Chronic	2.4E-02	mg/kg/day	0.04	9.6E-04	mg/kg/day	CNS	1/3	IRIS	4/23/2008
Selenium	Chronic	5.0E-03	mg/kg/day	1	5.0E-03	mg/kg/day	Skin	3/1	IRIS	4/23/2008
Silver	Chronic	5.0E-03	mg/kg/day	0.04	2.0E-04	mg/kg/day	Skin	3/1	IRIS	4/23/2008
Zinc	Chronic	3.0E-01	mg/kg/day	1	3.0E-01	mg/kg/day	Blood	3/1	IRIS	4/23/2008

Notes:

- 1 U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
- 2 Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.
- 3 Values are for pyrene.

Definitions:

CNS = Central Nervous System

CVS = Cardiovascular system

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

GS = Gastrointestinal system

IRIS = Integrated Risk Information System

NA = Not Applicable

TABLE 5.2 NON-CANCER TOXICITY DATA -- INHALATION SITE 23 - STORM SEWER NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Chronic/ Subchronic		ition RfC	Extrapo	lated RfD ⁽¹⁾	Primary Target	Combined Uncertainty/Modifying	RfC : Tar	get Organ(s)
Concern		Value	Units	Value	Units	Organ(s)	Factors	Source(s)	Date(s)
Volatile Organic Compounds									T (MANUSSITITE
Tetrachloroethene	Chronic	2.8E-01	mg/m ³	8.0E-02	(mg/kg/day)	Liver	NA I	USEPA III	10/11/2007
Semivolatile Organic Compounds					<u> </u>	· · · · · · · · · · · · · · · · · · ·	-1	OSEFAIII	10/11/2007
Benzo(a)anthracene	NA NA	NA	NA	NA	NA	NA	NA I	NA	1 514
Benzo(a)pyrene	NA NA	NA	NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Benzo(b)fluoranthene	NA NA	NA	NA	NA NA	NA I	NA NA	NA NA	NA NA	NA NA
Benzo(g,h,i)perylene	NA .	NA	NA	NA	NA NA	NA NA	NA NA		NA NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA NA	NA NA	NA NA	NA NA	NA NA
Bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA
Chrysene	NA	NA	NA NA	NA	NA NA	NA NA		NA NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
Diethylphthalate	NA .	NA	NA	NA NA	NA NA	NA NA	NA NA	NA	NA
Dimethylphthalate	NA	NA	NA	NA NA	NA NA	NA NA	NA NA	NA.	NA NA
Di-n-butylphthalate	NA NA	NA .	NA	NA NA	NA I	NA NA	NA NA	NA NA	NA NA
Fluoranthene	NA NA	NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA	NA NA
Naphthalene	Chronic	3.0E-03	mg/m ³	8.6E-04	 		NA NA	NA	NA NA
Phenanthrene	NA	NA NA	NA NA	NA	(mg/kg/day) NA	Nasal	3000/1	IRIS	4/23/2008
Pyrene	NA NA	NA	NA NA	NA NA	NA NA	NA .	NA NA	NA NA	NA
norganics	· · · · · · · · · · · · · · · · · · ·			I NA	NA	NA NA	NA NA	NA NA	NA
Aluminum	Chronic	0.005	mg/m3	1.4E-03	(m = 0 = (d =)	0110			
Antimony	NA NA	NA.	NA NA	1.4E-03 NA	(mg/kg/day)	CNS	300	PPRTV	10/23/2006
Arsenic	NA NA	NA NA	NA NA		NA NA	NA NA	NA NA	NA NA	NA
Barium	Chronic	5.0E-04	mg/m3	NA 1.45.04	NA I	NA NA	NA NA	NA NA	NA NA
Beryllium	Chronic	2.0E-05		1.4E-04	(mg/kg/day)	Fetotoxicity	1000	HEAST	7/97
Chromium	Chronic	1.0E-04	mg/m3 mg/m³	5.7E-06	(mg/kg/day)	GS	10/1	IRIS	4/23/2008
Cobalt	NA NA	NA		2.9E-05	(mg/kg/day)	Lungs	300/1	IRIS	4/23/2008
Copper	NA NA	NA NA	NA NA	NA NA	NA NA	NA	NA	NA	NA.
ron	NA I	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA	NA
/anganese	Chronic		NA3	NA	NA NA	. NA	NA	NA	NA NA
Selenium	NA NA	5.0E-05 NA	mg/m³	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	4/23/2008
Silver	NA NA		NA ·	NA NA	NA NA	NA NA	NA NA	NA	NA
line		NA NA	NA	NA .	NA	NA	NA	NA	NA
	NA	NA NA	NA	NA	NA ·	NA	NA NA	NA	NA

Notes

1 - Extrapolated RfD = RfC *20m3/day / 70 kg

Definitions:

CNS = Central Nervous System

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

GS = Gastrointestinal

HEAST= Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information System

NA = Not Applicable

TABLE 6.1 **CANCER TOXICITY DATA -- ORAL/DERMAL** SITE 23 - STORM SEWER NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Oral Cancer	Slope Factor	Oral Absorption Efficiency		cer Slope Factor ermal ⁽²⁾	Weight of Evidence/ Cancer Guideline	Ora	I CSF
Concern	Value	Units	for Dermai ⁽¹⁾	Value	Units	Description	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds								
Tetrachloroethene	5.4E-01	(mg/kg/day)-1	1	5.4E-01	(mg/kg/day)-1	NA L	IRIS	4/23/2008
Semivolatile Organic Compo	unds							
Benzo(a)anthracene	7.3E-01	(mg/kg/day) '	1	7.3E-01	(mg/kg/day) ⁻¹	B2	USEPA(1)	7/1993
Benzo(a)pyrene	7.3E+00	(mg/kg/day) ⁻¹	1	7.3E+00	(mg/kg/day) ⁻¹	B2	IRIS	7/20/2007
Benzo(b)fluoranthene	7.3E-01	(mg/kg/day)	1	7.3E-01	(mg/kg/day) ⁻¹	B2	USEPA(1)	7/1993
Benzo(g,h,i)perylene	NA	NA	NA NA	NA	NA NA	D	IRIS	
Benzo(k)fluoranthene	7.3E-02	(mg/kg/day) ⁻¹	1	7,3E-02	(mg/kg/day)	B2	USEPA(1)	7/1993
Bis(2-ethylhexyl)phthalate	1.4E-02	(mg/kg/day) ⁻¹	. 1	1.4E-02	(mg/kg/day) ⁻¹	B2	IRIS	4/23/2008
Chrysene	7.3E-03	(mg/kg/day)	1	7.3E-03	(mg/kg/day) ⁻¹	B2	USEPA(1)	7/1993
Dibenzo(a,h)anthracene	7.3E+00	(mg/kg/day)	1	7.3E+00	(mg/kg/day) ⁻¹	B2	USEPA(1)	7/1993
Diethylphthalate	NA .	NA NA	NA	NA	NA	D	IRIS	4/23/2008
Dimethylphthalate	NA NA	NA	NA	NA NA	NA	D	IRIS	4/23/2008
Di-n-butylphthalate	NA	NA	NA	. NA	NA NA	D	IRIS	4/23/2008
Fluoranthene	NA NA	NA	NA	NA	NA	D	IRIS	4/23/2008
Naphthalene	NA	NA NA	NA	NA	NA NA	С	IRIS	4/23/2008
Phenanthrene	NA NA	NA	NA NA	NA	NA NA	D	IRIS	4/23/2008
Pyrene	NA	NA	NA	NA	NA	D	IRIS	4/23/2008
Inorganics		<u> </u>						
Aluminum	NA NA	. NA	NA NA	NA	NA NA	NA	NA	NA.
Antimony	NA NA	NA	NA NA	NA	NA NA	NA NA	NA	NA
Arsenic	1.5E+00	(mg/kg/day)	1.	1.5E+00	(mg/kg/day)	Α	IRIS	4/23/2008
Barium	NA	NA.	NA	NA	NA	D	IRIS	4/23/2008
Beryllium	NA NA	NA NA	NA NA	NA	NA	B1	IRIS	4/23/2008
Chromium	NA	NA	NA NA	NA	NA	D	IRIS	4/23/2008
Cobalt	NA NA	NA NA	NA	NA	NA	NA	NA	NA
Copper	NA NA	NA NA	NA	NA	NA	D	IRIS	4/23/2008
Iron	NA.	NA .	NA	NA	NA	NA .	NA	NA
Manganese	NA NA	NA	NA	NA	NA	D	IRIS	4/23/2008
Selenium	NA NA	NA	. NA	NA	NA	D	IRIS	4/23/2008
Silver	NA.	NA	NA	NA	NA NA	D	IRIS	4/23/2008
Zinc	NA	NA NA	NA NA	NA .	NA	NA NA	NA	NA.

- 1 U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
- 2 Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007. IRIS = Integrated Risk Information System.

NA = Not Available.

EPA Group:

- A Human carcinogen.
- B1 Probable human carcinogen indicates that limited human data are available.
- B2 Probable human carcinogen indicates sufficient evidence in animals and inadequate or no evidence in humans .
- C Possible human carcinogen.
- D Not classifiable as a human carcinogen.
- E Evidence of noncarcinogenicity.

USEPA(1) = U.S. EPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.

TABLE 6.2 CANCER TOXICITY DATA -- INHALATION SITE 23 - STORM SEWER NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential		t Risk	1 .	on Cancer Factor ⁽¹⁾	Weight of Evidence/ Cancer Guideline	Unit Risk :	Inhalation CSF
Concern	Value	Units	Value	Units	Description	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds							
Tetrachloroethene	5.7E-06	(ug/m³) ⁻¹	2.0E-02	(mg/kg/day) ⁻¹	NA	USEPA III	10/11/2007
Semivolatile Organic Compou	ınds						
Benzo(a)anthracene	NA	NA	NA .	NA	NA NA	NA	l NA
Benzo(a)pyrene	8.9E-04	(ug/m ³) ⁻¹	3.1E+00	(mg/kg/day) ⁻¹	NA NA	USEPA III	10/11/2007
Benzo(b)fluoranthene	NA NA	NA	NA	NA	NA NA	NA	NA NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	D	IRIS	4/23/2008
Benzo(k)fluoranthene	NA	NA .	NA	NA	NA NA	NA	NA NA
Bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	B2	IRIS	4/23/2008
Chrysene	NA	. NA	NA	NA	NA NA	NA NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA NA	NA NA	NA NA
Diethylphthalate	NA	NA	NA ·	NA NA	D	IRIS	4/23/2008
Dimethylphthalate	NA	. NA	NA .	NA.	D D	IRIS	4/23/2008
Di-n-butylphthalate	NA	NA	NA	NA NA	D	IRIS	4/23/2008
Fluoranthene	NA NA	NA NA	NA	NA NA	<u> </u>	IRIS	4/23/2008
Naphthalene	NA	NA	NA	NA NA	c	IRIS	4/23/2008
Phenanthrene	NA	NA	NA	NA NA	D	IRIS	4/23/2008
Pyrene	NA	NA	NA	NA	` D	IRIS	4/23/2008
norganics							1 4/25/2000
Aluminum	NA NA	NA	NA NA	NA I	NA	NA	NA.
Antimony	NA NA	NA	NA	NA	NA.	NA.	NA NA
Arsenic	4.3E-03	(ug/m³)-1	1.5E+01	(mg/kg/day) ⁻¹	A	IRIS	4/23/2008
Barium	NA	NA	NA	NA	В	IRIS	4/23/2008
Beryllium	2.4E-03	(ug/m ³) ⁻¹	8.4E+00	(mg/kg/day) ⁻¹	B1	IRIS	4/23/2008
Chromium	1.2E-02	(ug/m ³) ⁻¹	4.2E+01	(mg/kg/day) ⁻¹	A	IRIS	4/23/2008
Cobalt	. NA	NA	NA	NA NA	NA NA	. NA	NA
Copper	NA	NA	NA	NA NA	D	IRIS	4/23/2008
ron	NA	NA	NA NA	NA NA	NA NA	NA NA	NA
Manganese	NA NA	NA	NA	NA NA	D	IRIS	4/23/2008
Selenium	NA	NA	NA.	NA NA	D	IRIS	4/23/2008
Silver	NA	NA	NA.	NA NA	D	IRIS	4/23/2008
Zinc	NA NA	NA	NA.	NA NA	D	IRIS	4/23/2008

Notes

1 - Inhalation CSF = Unit Risk * 70 kg / 20m3/day.

Definitions:

IRIS = Integrated Risk Information System.

NA = Not Available.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

EPA Group:

- A Human carcinogen.
- B1 Probable human carcinogen indicates that limited human data are available.
- B2 Probable human carcinogen indicates sufficient evidence in animals and inadequate or no evidence in humans .
- C Possible human carcinogen.
- D Not classifiable as a human carcinogen.
- E Evidence of noncarcinogenicity.

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 2

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	Ε	PC	1	Car	ncer Risk Calcula	ntions		L	Non-Ca	ncer Hazard C	alculations	
		**	1.	Potential Concern	Value	Units	Intake/Exposu	re Concentration	CSF/	Jnit Risk	Cancer Risk	Intake/Exposu	re Concentration	Rf	D/RIC	Hazard Quotier
					1	L	Value	Units	Value	Units		Value	Units	Value	Units	
roundwater	Groundwater	Site 23	Dermal	Aluminum	2540	ug/L	5.6E-07	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		3.9E-05	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.00004
	*			Antimony	3.20	ug/L	7.1E-10	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹	'	5.0€-08	(mg/kg/day)	6.0E-05	(mg/kg/day)	0.0008
		1		Arsenic	9.10	ug/L	2.0E-09	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	3.0E-09	1.4E-07	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.0005
		1		Barium	96.7	ug/L	2.1E-08	(mg/kg/day)	NA.	(mg/kg/day)"		1.5E-06	(mg/kg/day)	1.4E-02	(mg/kg/day)	0.0001
	1		1	Beryllium	0.980	ug/L	2.2E-10	(mg/kg/day)	NA .	(mg/kg/day) 1	••	1.5E-08	(mg/kg/day)	1.4E-05	(mg/kg/day)	0.001
]	Chromium	6.50	ug/L	2.9E-09	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹	••	2.0E-07	(mg/kg/day)	7.5E-05	(mg/kg/day)	0.003
		1		Cobalt	4.40	ug/L	9.7E-10	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		6.8E-08	(mg/kg/day)	NA	(mg/kg/day)	-
				Copper	. 10.6	ug/L	2.3E-09	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.6E-07	(mg/kg/day)	4.0E-02	(mg/kg/day)	0.000004
				Iron	62500	ug/L	1.4E-05	(mg/kg/day)	NA	(mg/kg/day) ¹	••	9.7E-04	(mg/kg/day)	7.0E-01	(mg/kg/day)	0.001
				Manganese	1630	ug/L	3.6E-07	(mg/kg/day)	NA.	(mg/kg/day)		2.5E-05	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.03
				Selenium	5.40	ug/L	1.2E-09	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		8.4E-08	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.00002
				Silver	1.90	ug/L	2.5E-10	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	'	1.8E-08	(mg/kg/day)	2.0E-04	(mg/kg/day)	0.00009
				Zinc	87.9	ug/L	1.2E-08	(mg/kg/day)	NA NA	(mg/kg/day)	••	8.2E-07	(mg/kg/day)	3.0E-01	(mg/kg/day)	0.000003
				Tetrachloroethene	0.500	ug/L	5.1E-09	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	2.8E-09	3.6E-07	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.00004
]	Dimethylphthalate	1.10	ug/L	5.6E-10	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		3.9E-08	(mg/kg/day)	NA	(mg/kg/day)	-
	ŀ			Diethylphthalate	20.0	ug/L	3.3E-08	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹	••	2.3E-06	(mg/kg/day)	8.0E-01	(mg/kg/day)	0.000003
]	Di-n-butylphthalate	10.0	ug/L	1.3E-07	(mg/kg/day)	NA NA	(mg/kg/day) ¹	•• .	9.1E-06	(mg/kg/day)	1.0E-01	(mg/kg/day)	0.00009
				Bis(2-Ethylhexyl)phthalate	20.0	ug/L	5.0E-07	(mg/kg/day)	1.4E-02	(mg/kg/day) 1	7.0E-09	3.5E-05	(mg/kg/day)	2.0E+02	(mg/kg/day)	0.002
			1	Naphthalene	0.370	ug/L	4.5E-09	(mg/kg/day)	NA NA	(mg/kg/day)"		3.1E-07	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.00002
			İ	Phenanthrene	0.580	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Fluoranthene	0.580	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	
				Pyrene	0.520	ug/L	3.7E-08	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		2.6E-06	(mg/kg/day)	3.0E-02	(mg/kg/day)	0.00009
	Î			Benzo(a)anthracene	0.250	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Chrysene	0.210	ug/L	0.0E+00	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(b)fluoranthene	0.450	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(k)fluoranthene	2.00	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
]	Benzo(a)pyrene	0.620	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Dibenzo(a,h)anthracene	0.500	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(g.h.i)perylene	0.620	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			Exp. Route Total				l	<u></u>			1.3E-08					0.04
		Exposure Point Total		<u> </u>							1.3E-08					0.04
	Exposure Medium Total	**************************************			*************						1.3E-08					0.04

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT

PAGE 2 OF 2

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

	Exposure Medium	Exposure Point	Exposure Route		L	PC		Ca	ncer Risk Calcu	lations						
			. 1	Potential Concern	Value	Units	Intake/Expost	re Concentration		/Unit Risk	Cancer Risk	intake/Evnos	Non-Ca are Concentration	ncer Hazard (Calculations fD/RfC	
Groundwater	Air						Value	Units	Value	Units .	Ourice, Mak	Value	Units	Value	Units	Hazard Quo
Groundwater	l'ar	Site 23	Inhalation	Aluminum	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)-1		0.0E+00	(mg/kg/day)	1.4E-03		
	1			Antimony	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	l	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-
	1			Arsenic	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	1.5E+01	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-
			1	Barium	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)*		0.0E+00	(mg/kg/day)	1.4E-04	(mg/kg/day)	-
		}		Beryllium	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	8.4E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	5.7E-06	(mg/kg/day)	"
	1		İ	Chromium	0.0E+0	mg/m3	0.0É+00	(mg/kg/day)	4.2E+01	(mg/kg/day)*		0.0E+00	(mg/kg/day)	2.9E-05	(mg/kg/day)	-
				Cobalt	0.0E+0	mg/m3	·0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	2.9E-03	(mg/kg/day)	
				Copper	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA:	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-
	ļ			Iron	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)*1		0.0E+00	1	NA NA	(mg/kg/day)	-
		1		Manganese	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)		(mg/kg/day)	-
				Selenium	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	1.4E-05	(mg/kg/day)	
			1	Silver	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	. NA	(mg/kg/day)*		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-
	İ			Zinc	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	"
	1		1	Tetrachloroethene	1.4E-5	mg/m3	2.4E-09	(mg/kg/day)	2.0E-02	(mg/kg/day) ⁻¹	4.8E-11	1.7E-07	(mg/kg/day)	NA -	(mg/kg/day)	-
	:		1	Dimethylphthalate	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	4.02-11	0.0E+00	(mg/kg/day)	8.0E-02	(mg/kg/day)	0.0000
				Diethylphthalate	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	-	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Di-n-butylphthalate	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹			(mg/kg/day)	NA	(mg/kg/day)	-
	, i			Bis(2-Ethylhexyl)phthalate	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	1	0.0E+00	(mg/kg/day)	ŅA	(mg/kg/day)	-
				Naphthalene	1.1E-5	mg/m3	1.8E-09	(mg/kg/day)	NA.	(mg/kg/day) 1	- :	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Phenanthrene	1.5E-5	mg/m3	2.6E-09	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		1.3E-07	(mg/kg/day)	8.6E-04	(mg/kg/day)	0.0001
				Fluoranthene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	ı	1.8E-07	(mg/kg/day)	NA	(mg/kg/day)	-
				Pyrene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA NA	1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Benzo(a)anthracene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)"		0.0E+00	(mg/kg/day)	. NA	(mg/kg/day)	
				Chrysene	0.0E+0	ma/m3	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)"		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	1		1	Benzo(b)fluoranthene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)"	• ••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Benzo(k)fluoranthene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(a)pyrene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	3.1E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA ((mg/kg/day)	
				Dibenzo(a,h)anthracene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	1			Benzo(g.h.i)perylene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)"	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			Exp. Route Total				0.02.00	(mg/kg/day)	NA	(mg/kg/day) '		0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	
	Γ	Exposure Point Total		V							4.8E-11					0.0002
	Exposure Medium Total										4.8E-11					0.0002
Medium Total											4.8E-11					0.0002
				<u> </u>						cross All Media	1.3E-08					0.04

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 2

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	LE	PC	L	Car	ncer Risk Calcula	tions		L	Non-Ca	ncer Hazard C	alculations	
	1	1	1	Potential Concern	Value	Units	Intake/Exposure	e Concentration	CSF/L	Init Risk	Cancer Risk	Intake/Exposu	re Concentration	Ří	D/RfC	. Hazard Quotie
			1	1			Value	Units	Value	Units		Value	Units	Value	Units	1
oundwater	Groundwater	Site 23	Ingestion	Aluminum	2540	ug/L	2.1E-02	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		2.4E-01	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.2
	- Cracinamata	0.10.20	gooo	Antimony	3.20	ug/L	2.6E-05	(mg/kg/day)	NA.	(mg/kg/day) ¹		3.1E-04	(mg/kg/day)	4.0E-04	(mg/kg/day)	0.8
	1			Arsenic	9.10	ug/L	7.5E-05	(mg/kg/day)	1.5E+00		1.1E-04	8.7E-04	(mg/kg/day)	3.0E-04	(mg/kg/day)	2.9
		1 .			1	1 -	A 1			(mg/kg/day)	E	8				0.05
				Barium	96.7	ug/L	7.9E-04	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		9.3E-03	(mg/kg/day)	2.0E-01	(mg/kg/day)	
		1	I	Beryllium	0.980	ug/L	8.1E-06	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		9.4E-05	(mg/kg/day)	2.0E-03	(mg/kg/day)	0.05
		1		Chromium	6.50	ug/L	5.3E-05	(mg/kg/day)	. NA	(mg/kg/day) ⁻¹		6,2E,-04	(mg/kg/day)	3.0E-03	(mg/kg/day)	0.2
			ł	Cobalt	4.40	ug/L	3.68-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		4.2E-04	(mg/kg/day)	NA	(mg/kg/day)	-
		ĺ		Copper	10.6	ug/L	8.7E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.0E-03	(mg/kg/day)	4.0E-02	(mg/kg/day)	0.03
		İ .		tron ·	62500	ug/L	5.1 £- 01	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		6.0E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	8.6
				Manganese	1630	ug/L	1.3E-02	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.6E-01	(mg/kg/day)	2.4E-02	(mg/kg/day)	6.5
				Selenium	5.40	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)*1		5.2E-04	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.1
				Silver	1.90	ug/L	1.6E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.8E-04	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.04
	1			Zinc	87.9	ug/L	7.2E-04	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		8.4E-03	(mg/kg/day)	3.0E-01	(mg/kg/day)	0.03
				Tetrachloroethene	0.500	ug/L	4.1E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	2.2E-06	4.8E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.005
				Dimethylphthalate	1,10	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)"		1.1E-04	(mg/kg/day)	NA.	(mg/kg/day)	
						-	11 1		1		į.	5	1		1	0.002
		Ì		Diethylphthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		1.9E-03	(mg/kg/day)	8.0E-01	(mg/kg/day)	1
				Di-n-butyiphthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	. NA	(mg/kg/day) '	••	9.6E-04	(mg/kg/day)	1.0E-01	(mg/kg/day)	0.010
				Bis(2-Ethylhexyl)phthalate	20.0	·ug/L	1.6E-04	(mg/kg/day)	1.4E-02	(mg/kg/day) ⁻¹	2.3E-06	1.9E-03	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.10
		1		Naphthalene	0.370	ug/L	3.0€-06	(mg/kg/day)	NA NA	(mg/kg/day) 1		3.5E-06	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.002
•		.		Phenanthrene	0.580	ug/L	4.8E-06	(mg/kg/day)	NA:	(mg/kg/day) ⁻¹		5.6E-05	(mg/kg/day)	NA NA	(mg/kg/day)	-
				Fluoranthene	0.580	ug/L	4.8E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		5.6E-05	(mg/kg/day)	4.0E-02	(mg/kg/day)	0.001
				Pyrene	0.520	ug/L	4.3E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		5.0E-05	(mg/kg/day)	3.0E-02	(mg/kg/day)	0.002
				Benzo(a)anthracene	0.250	ug/L	1.1E-05	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	8.0E-06	2.4E-05	(mg/kg/day)	NA.	(mg/kg/day)	-
			1	Chrysene	0.210	ug/L	1.7E-06	(mg/kg/day)	7.3E-03	(mg/kg/day) 1	1.3E-08	2.0E-05	(mg/kg/day)	NA	(mg/kg/day)	-
			1.	Benzo(b)fluoranthene	0.450	ug/L	2.0E-05	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	1.4E-05	4.3E-05	(mg/kg/day)	NA.	(mg/kg/day)	
		* *		Benzo(k)fluoranthene	2.00	ug/L	8.8E-05	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹	6.4E-06	1.9E-04	(mg/kg/day)	NA	(mg/kg/day)	
			1	Benzo(a)pyrene	0.620	ug/L	2.7E-05	(mg/kg/day)	7.3E+00		2.0E-64	5.9E-05	(mg/kg/day)	NA.	(mg/kg/day)	l
					1	1 -	2.7E-05 2.2E-05		7.3E+00	(mg/kg/day)	1.6E-04	4.8E-05		NA.	(mg/kg/day)	
	1		1 -	Dibenzo(a,h)anthracene	0.500	ug/L	7	(mg/kg/day)		(mg/kg/day) ⁻¹		1	(mg/kg/day)	NA NA	1	"
	-			Benzo(g,h,i)perylene	0.620	ug/L	5.1E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		5.9E-05	(mg/kg/day)	NA NA	(mg/kg/day)	
	1		Exp. Route Total		,	,	 ,				5.0E-04		,			20
		Ī	Dermal	Aluminum .	2540	ug/L	7.7E-06	(mg/kg/day)	NA NA	(mg/kg/day)	•••	2.7E-04	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.000
	1			Antimony	3.20	ug/L	9.6E-09	(mg/kg/day)	. NA	(mg/kg/day) ⁻¹	1	3.4E-07	(mg/kg/day)	6.0E-05	(mg/kg/day)	0.006
	1		1	Arsenic	9.10	ug/L	2.7E-08	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	4.1E-08	9.6E-07	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.003
	1		1	Barium	96.7	ug/L	2.9E-07	(mg/kg/day)	NA NA	(mg/kg/day) 1	••	1.0E-05	(mg/kg/day)	1.4E-02	(mg/kg/day)	0.000
			1	Beryllium	0.980	ug/L	3.0E-09	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		1.0E-07	(mg/kg/day)	1.4E-05	(mg/kg/day)	0.007
			1	Chromium	6.50	ug/L	3.9E-08	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		1.4E-06	(mg/kg/day)	7.5E-05	(mg/kg/day)	0.02
	1			Cobalt	4.40	ug/L	1,3E-08	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		4.6E-07	(mg/kg/day)	NA	(mg/kg/day)	-
			1	Copper	10.6	ug/L	3.2E-08	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		1.1E-06	(mg/kg/day)	4:0E-02	(mg/kg/day)	0.0000
			i	Iron	62500	ug/L	195-04	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		6.6E-03	(mg/kg/day)	7.0E-01	(mg/kg/day)	0.009
			1	Manganese	1630	ug/L	4.9E-06	(mg/kg/day)	NA.	(mg/kg/day):1		1.7E-04	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.2
				Selenium	5.40	ug/L	0.0E+00	(mg/kg/day)	NA.			5.7E-07	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.000
					1	1 -			NA NA	(mg/kg/day) 1		1.2E-07		2.0E-04		0.000
	1 1			Silver	1.90	ug/L	3.4E-09	(mg/kg/day)		(mg/kg/day) 1	1	1	(mg/kg/day)		(mg/kg/day)	
	1	1.	1	Zinc	87.9	ug/L	1.6E-07	(mg/kg/day)	· NA	(mg/kg/day) ¹	••	5.6E-06	(mg/kg/day)	3.0E-01	(mg/kg/day)	0.0000
				Tetrachioroethene	0.500	ug/L	2.7E-07	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.4E-07	9.3E-06	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.000
	1.		1	Dimethylphthalate	1.10	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ^{*1}	••	1.0E-06	(mg/kg/day)	NA	(mg/kg/day)	-
	1		1	Diethylphthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		6.2E-05	(mg/kg/day)	8.0E-01	(mg/kg/day)	0.0000
	1		1	Di-n-butylphthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		2.5E-04	(mg/kg/day)	1.0E-01	(mg/kg/day)	0.002
	1		1	Bis(2-Ethylhexyl)phthalate	20.0	ug/L	2.7E-05	(mg/kg/day)	1.4E-02	(mg/kg/day)"	3.8E-07	9.5E-04	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.05
	1			Naphthalene	0.370	ug/L	2.1E-07	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		7.5E-06	(mg/kg/day)	2.0€-02	(mg/kg/day)	0.000
	1		.]	Phenanthrene	0.580	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	٠	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	1			Fluoranthene	0.580	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)		0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	_
	1		-		1		11 1		NA NA			7.0E-05		3.0E-02	ľ	0.002
	1		1	Pyrene	0.520	ug/L	2.0E-06	(mg/kg/day)		(mg/kg/day)	l	0	(mg/kg/day)		(mg/kg/day)	0.002
			1	Benzo(a)anthracene	0.250	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	,
		1	1 '	Chrysene	0.210	ug/L	0.0E+00	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
	1	1	1	Benzo(b)fluoranthene	0.450	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of		EPC		C-	ncer Risk Calcul	ellene						
		l	1	Potential Concern	Value	Units	Intake/Evans	re Concentration						ancer Hazard (
					1		Value	Units	Value CSF/	Unit Risk Units	Cancer Risk		re Concentration		ID/RIC	Hazard Quo
Groundwater	Groundwater	Site 23	Dermal	Benzo(k)fluoranthene	2.00	ug/L	0.0E+00					Value	Units	Value	Units	
			1	Benzo(a)pyrene	0.620		#	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			ļ	Dibenzo(a,h)anthracene	0.500	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) 1	••	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	-
				Benzo(g,h,i)perylene	0.620	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	. NA	(mg/kg/day)	
			Exp. Route Total		0.620	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	-
		Exposure Point Total	A supp. recola rotal				ļ				5.6E-07					0.3
	Exposure Medium Total										5.0E-04					20
undwater	Air	Site 23	Inhalation	Aluminum	_		<u> </u>				5.0E-04					20
		GIIO ZD	Milialation		2540	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	1.0E+00	(mg/kg/day)	-
	1		1	Antimony	3.20	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	4.0E-04	(mg/kg/day)	
	1			Arsenic	9.10	ug/L	0.0E+00	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	3.0E-04	(mg/kg/day)	
	1		1	Barium	96.7	ug/L	0.0E+00	(mg/kg/day)	. NA	(mg/kg/day) ⁻¹		0.0E+00 ;	(mg/kg/day)	2.0E-01	(mg/kg/day)	
	1		1	Beryllium	0.980	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	2.0E-03	(mg/kg/day)	
				Chromium	6.50	ug/L	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	3.0E-03	(mg/kg/day)	
	i		į.	Cobalt	4.40	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
				Copper	10.6	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)**		0.0€+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	
	1		ł	Iron	62500	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	
				Manganese	1630	ug/L	- 0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	1	0.0E+00	(mg/kg/day)	2.4E-02	(mg/kg/day)	-
	1:			Selenium	5.40	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	5.0E-03		"
	ĺ		i	Silver	1.90	. ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	5.0E-03	(mg/kg/day)	
	1 1		1	Zinc	87.9	ug/L	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		0.0E+00	1		(mg/kg/day)	-
				Tetrachloroethene	0.500	ug/L	4.1E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	2 2E-06	4.8E-05	(mg/kg/day)	3.0E-01	(mg/kg/day)	i -
	i			Dimethylphthalate	1.10	υg/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)		0.0E+00	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.005
				Diethylphthelate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
	}			Di-n-butylphthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	NA	1	1		(mg/kg/day)	8.0E-01	(mg/kg/day)	-
	i		1	Bis(2-Ethylhexyl)phthatate	20.0	ug/L	0.0€+00	(mg/kg/day)	1.4E-02	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	1.0E-01	(mg/kg/day)	-
				Naphthalene	0.370	ug/L	3.0E-06	(mg/kg/day)	NA NA	(mg/kg/day)	[0.0E+00	(mg/kg/day)	2.0E-02	(mg/kg/day)	-
	ļ		İ	Phenanthrene	0.580	ug/L	0.0E+00	(mg/kg/day)		(mg/kg/day) '		3.5E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.002
	Í		1 .	Fluoranthene	0.580	ug/L	0.0E+00		, NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			l	Pyrene	0.520	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	[0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	-
	i i			Benzo(a)anthracene	0.250	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	3.0€-02	(mg/kg/day)	
			1 1	Chrysene	0.210			(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0€+00	(mg/kg/day)	- NA	(mg/kg/day)	• .
	1		, ,	Benzo(b)fluoranthene	0.450	ug/L	0.0E+00	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹	[0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1 .			ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ¹	[0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1 (Benzo(k)fluoranthene Benzo(a)pyrene	2.00	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	
	1.				0.620	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day)"	[0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	_
			1 1	Dibenzo(a,h)anthracene	0.500	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	l . I			Benzo(g,h,i)perylene	0.620	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	<u> </u>	Evoneure Daini Tarri	Exp. Route Total								2.2E-06					0.007
	Exposure Medium Total	Exposure Point Total			يرون المستحدث						2.2E-06		***************************************			0.007
Medium Total	Exposure medium 10(8)										2.2E-06					0.007
ANGUIN TURE											5.1E-04					20
									Receptor Risks A	-	5.1E-04					20

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwate

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZAROS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 2

Scensrio Timeframe: Future Receptor Population: Residents Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	F	PC	1	Ca	ncer Risk Calcula	tions			Non-Ca	ncer Hazard C	alculations	
Mediam		Exposure / will		Potential Concern	Value	Units	Intake/Exposur	e Concentration		Jnil Risk	Cancer Risk	Intake/Exposu	re Concentration		DIRIC	Hazard Quotier
	1.				,	1	Value	Linits	Value	Units	Cancerna	Value	Units	Value	Units	1
iroundwater	Groundwater	Site 23	Ingestion	Aluminum	2540	ug/L	2.0E-02	(mg/kg/day)	NA .	(mg/kg/day) 1		1.7E-01	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.2
CONGWARE	Grounowater	Site 23	1		I	1	2.5E-05		NA NA			2.1E-04		4.0E-04	(mg/kg/day)	0.5
			1	Antimony	3.20	ug/L	8	(mg/kg/day)	1	(mg/kg/day)			(mg/kg/day)	3.0E-04		2.0
	1		1	Arsenic	9.10	ug/L	7.1E-05	(mg/kg/day)	1.5E+00	(mg/kg/day)	1,1E-04	6.0E-04	(mg/kg/day)		(mg/kg/day)	i
			1	Banum	96.7	ug/L	7.6E-04	(mg/kg/day)	· NA	(mg/kg/day) ⁻¹		6.4E-03	(mg/kg/day)	2.0E-01	(mg/kg/day)	0.03
			1	Beryllium	0.980	ug/L	7.7E-06	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	••	6.4E-05	(mg/kg/day)	2.0E-03	(mg/kg/day)	0.03
			1	Chromium	6.50	ug/L	5.1E-05	(mg/kg/day)	NA.	(mg/kg/day)*		4.3E-04	(mg/kg/day)	3.0E-03	(mg/kg/day)	0.1
	İ	i		Cobalt	4.40	ug/L	3.4E-05	(mg/kg/day)	NA NA	(mg/kg/day)"		2.9E-04	(mg/kg/day)	NA	(mg/kg/day)	-
•			1	Copper	10.6	ug/L	8.3E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹	•• .	7.0E-04	(mg/kg/day)	4.0E-02	(mg/kg/day)	0.02
		1	1	iron .	62500	ug/L	4.9E-01	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		4.1E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	5.9
	ł		1	Manganese	1630	ug/L	1.3E-02	(mg/kg/day)	NA '	(mg/kg/day) ⁻¹		1.1E-01	(mg/kg/day)	2.4E-02	(mg/kg/day)	4.5
	ŀ		1	Setenium	5.40	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	••	3.6E-04	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.07
	4		1	Silver	1.90	ug/L	1.5E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.2E-04	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.02
	l	}	1	Zinc	87.9	ug/L	6.9E-04	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		5.8E-03	(mg/kg/day)	3.0E-01	(mg/kg/day)	0.02
			j	Tetrachloroethene	0.500	ug/L	3.9E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ¹	2.1E-06	3.3E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.003
	Į	1		Dimethylphthalate	1.10	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		7.2E-05	(mg/kg/day)	NA.	(mg/kg/day)	
		1	1	Diethylphthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		1.3E-03	(mg/kg/day)	8:0E-01	(mg/kg/day)	0.002
		1 .		Di-n-butylphthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)*		6.6E-04	(mg/kg/day)	1.0E-01	(mg/kg/day)	0.007
		1	1	1	20.0	1 .	1.6E-04		1.4E-02	1	2.2E-06	1.3E-03	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.07
		1	1.1	Bis(2-Ethýlhexyl)phthalate	1	ug/L	1	(mg/kg/day)	1	(mg/kg/day)	5			2.0E-02	1	0.001
		1		Naphthalene	0.370	ug/L	2.9E-06	(mg/kg/day)	NA	(mg/kg/day)		2.4E-05	(mg/kg/day)		(mg/kg/day)	0.001
		ł	}	Phenanthrene	0.580	ug/L	4.5E-06	(mg/kg/day)	NA.	(mg/kg/day)	••	3.8E-05	(mg/kg/day)	NA	(mg/kg/day)	
				Fluoranthene	0.580	ug/L	4.5E-06	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		3.8E-05	(mg/kg/day)	4.0E+02	(mg/kg/day)	0.0010
		i		Pyrene	0.520	ug/L	4.1E-06	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		3.4E-05	(mg/kg/day)	3.0E-02	(mg/kg/day)	0.001
	1	1	· ·	Benzo(a)anthracene	0.250	ug/L	3.9E-06	(mg/kg/day)	7.3E-01	(mg/kg/day) '	2.9E-06	1.6E-05	(mg/kg/day)	NA	(mg/kg/day)	-
				Chrysene	0.210	ug/L	1.6E+06	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹	1.2E-08	1.4E-05	(mg/kg/day)	NA .	(mg/kg/day)	-
	l			Benzo(b)fluoranthene	0.450	ug/L	7.0E-06	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	5.1E-06	3.0E-05	(mg/kg/day)	. NA	(mg/kg/day)	
		ł		Benzo(k)fluoranthene	2.00	ug/L	3.1E-05	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹	2.3E-06	1.3E-04	(mg/kg/day)	NA.	(mg/kg/day)	-
	l	1		Benzo(a)pyrene	0.620	ug/L	9.7E-06	(mg/kg/day)	- 7.3E+00	(mg/kg/day) ⁻¹	7.1E-05	4.1E-05	(mg/kg/day)	NA	(mg/kg/day)	
	i			Dibenzo(a,h)anthracene	0.500	ug/L	7.8E-06	(mg/kg/day)	7.3E+00	(mg/kg/day)"	5.7E-05	3.3E-05	(mg/kg/day)	NA	(mg/kg/day)	
	l		ł	Benzo(g,h,i)perylene	0.620	ug/L	4.9E-06	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		4.1E-05	(mg/kg/day)	NA.	(mg/kg/day)	
			Exp. Route Total		1	1	1		·	1 (2.5E-04	-			1	13
		1	Dermal	Aluminum	2540	ug/L	5.4E-05	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		3.8E-04	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.0004
	1			Antimony	3.20	ug/L	6.8F-08	(mg/kg/day)	NA.	(mg/kg/day)"	l	4.7E-07	(mg/kg/day)	6.0E-05	(mg/kg/day)	0.008
		ļ	ı	Arsenic	9.10	ug/L	1.9E-07	(mg/kg/day)	1.5E+00	(mg/kg/day) ¹	2.9E-07	1.3E-06	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.004
	'	1	i	Barium	96.7		2.0E-06	(mg/kg/day)	NA NA		2.52-07	1.4E-05	(mg/kg/day)	1.4E-02	(mg/kg/day)	0.001
			1		1	ug/L	1		ı	(mg/kg/day) 1	ľ	1.4E-07	1	1.4E-02	1	0.001
			l	Beryllium	0.980	ug/L	2.1E-08	(mg/kg/day)	NA	(mg/kg/day)			(mg/kg/day)	7.5E-05	(mg/kg/day)	
		l		Chromium	6.50	ug/L	2.7E-07	(mg/kg/day)	NA NA	(mg/kg/day)"		1.9E-06	(mg/kg/day)		(mg/kg/day)	0.03
	į.		1	Cobalt	4.40	ug/L	9.3E-08	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		6.5E-07	(mg/kg/day)	NA	(mg/kg/day)	-
		1	1	Copper	10.6	ug/L	2.2E-07	(mg/kg/day)	NA.	(mg/kg/day)		1.6E-06	(mg/kg/day)	4.0E-02	(mg/kg/day)	0.00004
		1	1	iron	62500	ug/L	1.3E-03	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		9.2E-Q3	(mg/kg/day)	7.0E-01	(mg/kg/day)	0,01
	ŀ		į	Manganese	1630	ug/L	3.4E-05	(mg/kg/day)	, NA	(mg/kg/day) ⁻¹	••	2.4E-04	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.3
				Selenium	5.40	ug/L	0.0€+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		8.0€-07	(mg/kg/day)	5.0E-03	(mg/kg/day)	0.0002
			ĺ	Silver	1.90	ug/L	2.4E-08	(mg/kg/day).	NA.	(mg/kg/day)*1		1.7E-07	(mg/kg/day)	2.0E-04	(mg/kg/day)	0.0008
				Zinc	87.9	ug/L	1.1E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		7.8E-06	(mg/kg/day)	3.0E-01	(mg/kg/day)	0.00003
	*	1	ļ	Tetrachloroethene	0.500	ug/L	1.9E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.0€-06	1.3E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.001
				Dimethylphthalate	1.10	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		1.4E-06	(mg/kg/day)	NA.	(mg/kg/day)	-
1	<u> </u>	1		Diethylphthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		8.7E-05	(mg/kg/day)	8.0E-01	(mg/kg/day)	0.0001
				Di-n-butylphthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		3.5E-04	(mg/kg/day)	1.0E-01	(mg/kg/day)	0.003
	1	Į.	ı	Bis(2-Ethylhexyl)phthalate	20.0	ug/L	1.9E-04	(mg/kg/day)	1.4E-02	(mg/kg/day) 1	2.7E-06	1.3E-03	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.07
				1	9.370		1.5E-06		NA		2.72.00	1.1E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.0005
				Naphthalene	1	ug/L	1	(mg/kg/day)	£	(mg/kg/day)				2.0E-02	1	0.000
	1 .			Phenanthrene	0.580	n8/r	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)		(mg/kg/day)	
	1		l	Fluoranthene	0.580	nô/£	0.0E+00	(mg/kg/day)	. NA	(mg/kg/day)"	••	0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	-
		1	1	Pyrene	0.520	ug/L	1.4E-05	(mg/kg/day)	· NA	(mg/kg/day) ¹	• • •	9.9E-05	(mg/kg/day)	3.0E-02	(mg/kg/day)	0.003
		1		Benzo(a)enthracene	0.250	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
	Į.	[Chrysene	0.210	ug/L	0.0E+00	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
	i .		1	Benzo(b)fluoranthene	0.450	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	-

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS INSB-NLON, GROTON, CONNECTICUT

PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of		PC		Ca	ncer Risk Calcul	ations			Non-C	ancer Hazard (Calculations	
	1	· ·		Potential Concern	Value	Units	Intake/Exposu	re Concentration		Unit Risk	Cancer Risk	lotake/Evane	re Concentration		ID/RIC	T
	<u> </u>	1		1.			Value	Units	Value	Units	Cancer Nisk	Value	Units	Value	Units	Hazard Quoti
undwater	Groundwater	Site 23	Dermal	Benzo(k)fluoranthene	2.00	ug/L	0.0E+00	(mg/kg/day)	7.3E-02					-		
		İ		Benzo(a)pyrene	0.620	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹	l:	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
	1	· ·		Dibenzo(a,h)anthracene	0.500	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) '	···	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
	ł	1		Benzo(g.h,i)perylene	0.620	ug/L	0.0E+00	1		(mg/kg/day)"		0,0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			Exp. Route Total	Donatoly, in, in party liane	0.020	ugit	0.02+00	(mg/kg/day)	NA NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	-
		Exposure Point Total	LAP. HOUSE TOTAL				-				4.0E-06					0.4
	Exposure Medium Total										2.5E-04			·····		14
undwater	Air	Site 23	Inhalation	Aluminum	25.42						2.5E-04					14
	1		WITH BUILDING	4	2540	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)"		0.0E+00	(mg/kg/day)	1.0E+00	(mg/kg/day)	-
				Antimony	3.20	ug/L	0.0E+00	(mg/kg/day)	NA ·	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	4.0E-04	(mg/kg/day)	-
	1	ļ:		Arsenic	9.10	ug/L	0.0€+00	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	3.0E+04	(mg/kg/day)	-
			1	Barium	96.7	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	•	0.0E+00	(mg/kg/day)	2.0E-01	(mg/kg/day)	-
	Ì		1	Beryllium	0.980	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	2.0E-03	(mg/kg/day)	
			1	Chromium	6.50	ug/L	0.0E+00	(mg/kg/day)	- NA	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	3.0E-03	(mg/kg/day)	-
		į		Cobalt	4.40	ug/L	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
	Į.			Copper	10.6	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	_
				Iron	62500	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	
				Manganese	1630	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	2.48-02	(mg/kg/day)	
	1			Selenium	5.40	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	5.0E-03	(mg/kg/day)	
	ì			Silver	1.90	ug/L	0.0€+00	(mg/kg/day)	NA	(mg/kg/day)*		0.0E+00	(mg/kg/day)	5.0E-03	(mg/kg/day)	
			1	Zinc	87.9	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	3.0E-01	(mg/kg/day)	"
			i	Tetrachioroethene	0.500	ug/L	3.9E+06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	2.1E-06	3.3E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.003
				Dimethylphthalate	1.10	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day)	0.003
		•		Diethylphthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	8.0E-01	(mg/kg/day)	
			1	Di-n-butylohthalate	10.0	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		0.0E+00	1	1.0E-01		1
			1	Bis(2-Ethylhexyl)phthalate	20.0	ug/L	0.0E+00	(mg/kg/day)	1.4E-02	1		0.0E+00	(mg/kg/day)		(mg/kg/day)	, "
				Nachthalene	0.370	ug/L	2.9E-06	(mg/kg/day)	NA	(mg/kg/day) ⁻¹			(mg/kg/day)	2.0E-02	(mg/kg/day)	
	1		1	Phenanthrene	0.580	ug/L	0.0E+00	1		(mg/kg/day) ⁻¹		2.4E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.001
				Fluoranthene	0.580	ug/L	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA ·	(mg/kg/day)	-
			1	Pyrene	0.520	-		(mg/kg/day)	NA	(mg/kg/day)"		0.0E+00	(mg/kg/day)	4.0E-02	(mg/kg/day)	-
				Benzo(a)anthracene	1	ug/L	0.0€+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.05+00	(mg/kg/day)	3.0E-02	(mg/kg/day)	-
					0.250	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	1	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Chrysene	0.210	ug/L	0.0E+00	(mg/kg/day)	7.3E-03	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Benzo(b)fluoranthene	0 450	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	[0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	
			1	Benzo(k)fluoranthene	2.00	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			1	Benzo(a)pyrene	0.620	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			1	Dibenzo(a,h)anthracene	0.500	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			The second secon	Benzo(g,h,i)perylene	0.620	∪g/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
•			Exp. Route Total								2.1E-06					0.005
		Exposure Point Total									2.1E-06			-		0.005
	Exposure Medium Total										2.1E-06		···			0.005
Medium Total											2.6E-04					14
									Receptor Risks A		2.6E-04		Total of Rece			14

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS

NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermai	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
oundwater	Groundwater	Site 23	Aluminum						CNS	-		0.00004	0.00004
	1		Antimony				-		Blood			0.0008	0.0008
			Arsenic			3E-09		3E-09	Skin, CVS	-		0.0005	0.0005
			Barium		-				Kidney	-		0.0001	0.0001
			Beryllium						GS			0.001	0.001
			Chromium			٠	_		Fetotoxicity, GS, Bone			0.003	0.003
			Cobalt	1					NA NA				
			Copper				_	<u> </u>	GS	-		0.000004	0.000004
			Iron		-		_		GS GS	_		0.001	0.001
			Manganese	.					CNS			0.03	0.03
			Selenium				_	••	Skin			0.00002	0.00002
			Silver						Skin			0.00009	0.00009
			Zinc	l		l			Blood	<u></u>		0.000003	0.000003
			Tetrachloroethene			3E-09	· _	3E-09	Liver			0.00004	0.00004
			Dimethylphthalate						NA.	l			
			Diethylphthelate	l			_		Body Weight			0.000003	0.000003
			Di-n-butylphthalate	l	l				Mortality			0.00009	0.00009
			Bis(2-Ethylhexyl)phthalate			7E-09		7E-09	Liver			0.002	0.002
			Naphthalene	l					Body Weight			0.00002	0.00002
e e			Phenanthrene	I					Kidney			_	
•			Fluoranthene						Liver			_	·
			Pyrene		<u> </u>				Kidney			0.00009	0.00009
	. '		Benzo(a)anthracene	l	· <u> </u>				NA NA				
			Chrysene	1			-		NA NA				
*,			Benzo(b)fluoranthene						NA NA				
				1		l·		*	#			_	
			Benzo(k)fluoranthene		-		-		NA NA		i		
•			Benzo(a)pyrene		-	**	-		NA NA	-		-	-
			Dibenzo(a,h)anthracene		-		-	••	NA NA	-	"	-	-
,			Benzo(g,h,i)perylene				-		Kidney	<u> </u>			
	A 1		Chemical Total	<u> </u>	<u> </u>	1E-08	L	1E-08		<u> </u>	<u></u>	0.04	0.04
		Exposure Point Total		<u> </u>				1E-08 1E-08					0.04

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

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Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Chemical Point of Potential				Carcinogenio	: Risk			Non-Carcino	genic Hazard Q	luotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Site 23	Aluminum			-	-		CNS	 			Routes rotal
			Antimony				_		NA NA				
			Arsenic			_	_		NA.				
	1		Barium						Fetotoxicity		_		
		1	Beryllium			_	_		GS			· · ·	
			Chromium	<u></u>		_	_		Lungs				-
			Cobalt	_		_	-		NA NA				-
			Copper			-			NA NA		-		-
			Iron				_		NA NA	1	-		-
	İ	· ·	Manganese				_		CNS				_
	į		Selenium	-			_		NA NA		-		
			Silver						NA NA		-		
			Zinc			-	_				-	••	
			Tetrachloroethene		5E-11		` -	5E-11	NA .		-	••	l
			Dimethylphthalate				_	35-11	Liver		0.000002		0.000002
			Diethylphthalate			<u></u>			NA 		-		
			Di-n-butylphthalate	-			-		NA 		-	••	
	•		Bis(2-Ethylhexyl)phthalate			-	-	• •	NA		-	••	
			Naphthalene				-		NA .		-		
			Phenanthrene	1		-	. *	• •	Nasal		0.0001		0.0001
			Fluoranthene	•	••	•	-		. NA		-	••	
	·		i i	-		-	-		NA	••	-		
			Pyrene				-	• •-	NA NA				
			Benzo(a)anthracene	-		-	-	••	NA		- [
•			Chrysene			-	- '	••	NA .		-		
	1	· ·	Benzo(b)fluoranthene	-		-	-		NA		-	••	
		1	Benzo(k)fluoranthene	-	•••	-		••	NA .	••	-		
		l I	Benzo(a)pyrene		• ••		-	•-	NA	••	-	•	
		1	Dibenzo(a,h)anthracene	-		-	- 1		NA		-		
		1	Benzo(g,h,i)perylene			-			NA NA	••			
			Chemical Total		5E-11	-		5E-11			0.0002		0.0002
		Exposure Point Total			-			5E-11					0.0002
	Exposure Medium Total				· · · · · · · · · · · · · · · · · · ·			5E-11					0.0002
edium Total	****							1E-08					0.04
eceptor Total			<u> </u>			Recept	or Risk Total	1E-08			Rece	ptor HI Total	0.04

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 3

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	c Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater Groundwater	Groundwater	Site 23	Aluminum			••	(readiation)		CNS	0.2		0.0003	0.2
			Antimony	l					Blood	0.8		0.006	0.8
	-		Arsenic	1E-04		4E-08		1E-04	Skin, CVS	3		0.003	3
			Barium			••			Kidney	0.05		0.0007	0.05
			Beryllium			••			GS	0.05		0.007	0.05
			Chromium				-		Fetotoxicity, GS, Bone	0.2		0.02	0.2
			Cobalt						NA NA]		-
			Copper	l					GS	0.03		0.00003	0.03
			Iron	l		••			GS	9		0.009	9
			Manganese				-		CNS	7		0.2	7
			Selenium				_		Skin	0.1		0.0001	0.1
		1.	Silver						Skin	0.04		0.0006	0.04
			Zinc				_		Blood	0.03		0.00002	0.03
			Tetrachloroethene	2E-06		1E-07	-	2E-06	Liver	0.005		0.0009	0.006
	1		Dimethylphthalate				_		NA ·				
			Diethylphthalate		_				Body Weight	0.002		0.00008	0.002
			Di-n-butylphthalate				-		Mortality	0.010		0.002	0.01
			Bis(2-Ethylhexyl)phthalate	2E-06	I	4E-07		3E-06	Liver	0.10		0.05	0.1
	1		Naphthalene	.			_	1.	Body Weight	0.002		0.0004	0.002
		' '	Phenanthrene				-		Kidney				
			Fluoranthene				-		Liver	0.001			0.001
		· ·	Pyrene				-		Kidney	0.002		0.002	0.004
	İ		Benzo(a)anthracene	8E-06				8E-06	NA NA				
			Chrysene	1E-08	_		_ '	1E-08	NA NA				
			Benzo(b)fluoranthene	1E-05				1E-05	NA NA	-		_	
			Benzo(k)fluoranthene	6E-06	-			6E-06	NA NA	_			
			Benzo(a)pyrene	2E-04	- ·		_	2E-04	NA NA	_		_	
			Dibenzo(a,h)anthracene	2E-04			-	2E-04	NA NA	-	I	-	
]		Benzo(g,h,i)perylene		,.	'		••	Kidney	_		-	
			Chemical Total	5E-04		6E-07		5E-04	1	20		0.3	20
		Exposure Point Total	<u> </u>			· ····································		5E-04					20
*	-	Medium Total					-,	5E-04					20

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogeni	c Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Tot
oundwater	Groundwater	Site 23	Aluminum			-	-		CNS		-		
			Antimony	-		_			NA .	ļ <u>.</u> .			-
		1	Arsenic	-					NA NA		_		-
			Barlum	-			_		Fetotoxicity			••	-
			Beryllium					-	GS	1	i l	••	
			Chromium			_	'		Lungs		-		_
			Cobalt	·]					NA NA		-	• •	-
i		ļ	Copper	_		-			NA NA	-	-		-
	· ·	[Iron						NA NA		-		-
	· ·		Manganese	l			_		CNS		-	• • •	-
			Selenium]		_		NA NA		-	*-	
		1	Silver			-				-	•••	• •	-
			Zinc						NA NA		-	••	
			Tetrachloroethene		2E-06				NA 		- [
		1	Dimethylphthalate				l f	2E-06	Liver		0.005	'	0.005
		1	Diethylphthalate			-	-	••	NA	-	-	•••	
		l I	Di-n-butylphthalate				-		NA		-		
		1	Bis(2-Ethylhexyl)phthalate				-		NA	"			
		1	Naphthalene			-	- 1		NA .		-	••	
		1	Phenanthrene	_	• •	-	-	•-	Nasal		0.002		0.002
			Fluoranthene	1	-		-		NA NA		-	•	
		1	Pyrene	-		-	-	••	NA		-	••	
		1 1	Benzo(a)anthracene	-		-	-		NA .		- [••
		i .i	Chrysene	-	-	-	-		NA		-		••
				-	-	-	-		NA				
		1	Benzo(b)fluoranthene	-		-			NA NA		-		
		i i	Benzo(k)fluoranthene	-	•••		-		NA		-		
		1	Senzo(a)pyrene		• •	-	-		NA NA		-	••	
j		I I	Dibenzo(a,h)anthracene	-		-	-		NA	••,	-		
		l : (=	Benzo(g,h,i)perylene						NA '	••		[
ì	,		Chemical Total		2E-06			2E-06			0.007		0.007
ŀ	Exposure Medium Total	Exposure Point Total			-			2E-06				i i	0.007
ım Total	Exposure Medium Total							2E-06					0.007
un rotal			1					5E-04					

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 3 OF 3

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio					genic Hazard Q		
1		ł	Concern	Ingestion	Inhalation	Dermal	External	Exposure	Primary	Ingestion	Inhalation	Dermal	Exposure
							(Radiation)	Routes Total	Target Organ(s)				Routes Total

Total Body Weight HI	0.005
Total CNS HI	7
Total CVS HI	3
Total GS HI	9
Total Kidney HI	0.05
Total Liver HI	0.2
Total Skin HI	3
Total Nasal HI	0.002
Total Bone HI	0.2
Total Fetotoxicity HI	0.2
Total Mortality HI	0.01

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 3

Scenario Timeframe: Future Receptor Population: Residents

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk			Non-Carcino	genic Hazard C	uotient	
			Concern	Ingestion	Inhalation	Demai	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Tota
Groundwater	Groundwater	Site 23	Aluminum				-		CNS	0.2		0.0004	0.2
		+	Antimony			••	-		Blood	0.5		0.008	0.5
			Arsenic	1E-04		3E-07	-	1E-04	Skin, CVS	2		0.004	2
			Barium				-		Kidney	0.03		0.001	0.03
	·		Beryllium				-		GS	0.03		0.01	0.04
			Chromium		-	••	-		Fetotoxicity, GS, Bone	0.1		0.03	0.2
			Cobalt				-	••	NA NA			-	
			Copper		-	••	.		GS	0.02		0.00004	0.02
*		Î.	Iron			••			GS	6		0.01	6
			Manganese				_		CNS	4		0.3	5
	,		Selenium						Skin	0.07		0.0002	0.07
A contract of			Silver						Skin	0.02		0.0008	0.03
			Zinc					••	Blood	0.02		0.00003	0.03
			Tetrachloroethene	2E-06		1E-06	\ _	3E-06	Liver	0.003		0.000	0.005
	•]	Dimethylphthalate			••			NA NA				0.005
		İ	Diethylphthalate		<u>.</u>		_		Body Weight	0.002		0.0001	0.002
			Di-n-butylphthalate				_		Mortality	0.007		0.003	0.002
			Bis(2-Ethylhexyl)phthalate	2E-06		3E-06	_	5E-06	Liver	0.07		0.003	0.01
			Naphthalene				[Body Weight	0.001		0.0005	
			Phenanthrene		.		_		Kidney				0.002
			Fluoranthene						Liver	0.0010		-	2 2242
			Pyrene						Kidney	0.0010		-	0.0010
*:			Benzo(a)anthracene	3E-06			_	3E-06	NA NA			0.003	0.004
		·	Chrysene	1E-08		• •	_	1E-08	NA NA	-	. **	- .	
			Benzo(b)fluoranthene	5E-06			_	5E-06	NA				
		1	Benzo(k)fluoranthene	2E-06	_		_	2E-06		-	••		
·			Benzo(a)pyrene	7E-05			_	7E-05	NA NA	-		-	
			Dibenzo(a,h)anthracene	6E-05			_	7E-05 6E-05		-		-	
			Benzo(g,h,i)perylene	02-03					NA M	••		-	••
·			Chemical Total	2E-04	-	4E-06			Kidney				
		Exposure Point Total	onormosi (otal	21-04		46-00		3E-04		13		0.4	14
· ·		edium Total						3E-04 3E-04					14

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

Scenario Timeframe: Future Receptor Population: Residents

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	: Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Tota
roundwater	Groundwater	Site 23	Aluminum				_		CNS		-	••	
			Antimony	<u> </u>		_	-		NA				••
			Arsenic				_	••	. NA		-		
		İ	Barium	-				• ••	Fetotoxicity				
		İ	Beryllium			·-			GS		-	•	
			Chromium					·	Lungs		-	•-	
			Cobalt	-		-			NA .		-	••	
			Copper	-		-	-		NA NA		-	••	
			Iron	-		-	-	• • •	NA NA		-	•	-
			Manganese			-	-		CNS		-	••	
			Selenium			-			NA NA		-	••	
			Silver	-		-	-	••	NA .		-		
			Zinc	-		-	-		NA NA		-	••	
			Tetrachloroethene		2E-06	-	-	2E-06	Liver		0.003		0.003
	,		Dimethylphthalate	-		-	-		NA ·				
			Diethylphthalate				-	••	NA -		-		
			Di-n-butylphthalate	-		-	-		NA NA		-		
			Bis(2-Ethylhexyl)phthalate	-		-	-		NA NA		-		'
			Naphthalene	-		-	-	· :	Nasai		0.001		0.001
			Phenanthrene	-		-	-		. NA		-		
			Fluoranthene	-		ļ -	-		NA NA		-		
			Pyrene	-		-	-		NA NA			•	
			Benzo(a)anthracene	-		-	-,		NA NA		-		
		,	Chrysene			-	-		NA		-		
			Benzo(b)fluoranthene	-		-	-		NA NA		-	••	
			Benzo(k)fluoranthene	-		-	-		NA .		-	•-	
			Benzo(a)pyrene			-	-		NA NA		-		
			Dibenzo(a,h)anthracene			-	-	<i>;••</i>	NA		-		
			Benzo(g,h,i)perylene			-		•	· NA	<u></u>	-		
			Chemical Total		2E-06	-	-	2E-06		· ·	0.005		0.005
		Exposure Point Total						2E-06					0.005
	Exposure Medium Total							2E-06					0.005
edium Total								3E-04					14

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 3 OF 3

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Aduit

								· · · · · · · · · · · · · · · · · · ·							
Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk		Non-Carcinogenic Hazard Quotient						
			Concern	Ingestion	Inhalation	Dermal	External	Exposure	Primary	Ingestion	Inhalation	Dermal	Exposure		
							(Radiation)	Routes Total	Target Organ(s)	i i	1		Routes Total		

Total Body Weight HI	0.003
Total CNS HI	5
Total CVS HI	2
Total GS HI	6
Total Kidney HI	0.04
Total Liver HI	0.1
Total Skin HI	2
Total Nasal HI	0.001
Total Bone HI	0.2
Total Fetotoxicity HI	0.2
Total Mortality HI	0.01

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Lifelong (Child and Adult)

Non-Carcinogenic Hazard Quotient Chemical Carcinogenic Risk Medium Exposure Exposure Medium Point of Potential Inhalation Exposure Inhalation External Primary Ingestion Concern Ingestion Dermal Exposure (Radiation) Routes Total Target Organ(s) Routes Total Site 23 Groundwater Groundwater Aluminum Antimony Arsenic 2E-04 3E-07 2E-04 Barium - -. . Beryllium Chromium Cobalt . . •• Copper . . - -.. Iron Manganese Selenium - -Silver . . Zinc - -Tetrachloroethene 4E-06 1E-06 5E-06 Dimethylphthalate Diethylphthalate .. Di-n-butylphthalate 4E-06 3E-06 8E-06 Bis(2-Ethylhexyl)phthalate Naphthalene Phenanthrene - -Fluoranthene Pyrene . . Benzo(a)anthracene 1E-05 1E-05 Chrysene 2E-08 2E-08 2E-05 2E-05 Benzo(b)fluoranthene - -9E-06 Benzo(k)fluoranthene 9E-06 --Benzo(a)pyrene 3E-04 3E-04 . . 2E-04 Dibenzo(a,h)anthracene 2E-04

5E-06

8E-04

8E-04

Benzo(g.h,i)perylene Chemical Total

Exposure Point Total

Exposure Medium Total

8E-04

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - STORM SEWER REHABILITATION SAMPLING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Lifelong (Child and Adult)

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogeni	c Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Tot
Groundwater	Groundwater	Site 23	Aluminum			••	_		33				Roules For
			Antimony	l			_] ,		İ
		1	Arsenic	-		_				1			
		1	Barium			_	_			1			
			Beryllium		 	_		l					
			Chromium	_			_		 				
	1		Cobalt	-									
]		Copper							1			
			iron			_						*	
			Manganese			·				1			
			Selenium			-							
			Silver		:.		-	••					
			Zinc			_	-	•		1			
			Tetrachloroethene		4E-06								
			Dimethylphthalate		46-00	-	-	4E-06					
		2	Diethylphthalate			-	•]]			
			Di-n-butylphthalate			-	-				1		
			Bis(2-Ethylhexyl)phthalate				-	-					
			Naphthalene		••	-	-	••		į i			
	.*		Phenanthrene	-			-						
		ļ	Fluoranthene	"	••	-	-	. ••					
	•	İ	Pyrene	-	***	•		•-					
				-		- 1	-			1 1			
;	*	i	Benzo(a)anthracene				-					1	
	•	1	Chrysene	-		-				'			
		f I	Benzo(b)fluoranthene			-	- [••				-	
			Benzo(k)fluoranthene	-		-		`		•		İ	
			Benzo(a)pyrene		••	- '	-						
*		1	Dibenzo(a,h)anthracene	-	. ••	-	-						
		,	Benzo(g,h,i)perylene				<u> </u>				İ		
· ·		20/	Chemical Total		4E-06	-		4E-06			· · · · · · · · ·		
		Exposure Point Total						4E-06	" 	L	L		
	Exposure Medium Total							4E-06		······································			<u>-</u>
dium Total								8E-04				——	
eptor Total						Recent	or Risk Total	8E-04			-		

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

ATTACHMENT A.4

TABLES FROM QUARTERLY UNDERDRAIN METERING PIT SAMPLING

TABLE 3-1

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 3

PARAMETER	Surface Water Protection Criteria ⁽¹⁾	Residentiat Volatifization Criteria ⁽²⁾	Stormwater Discharge Permit Criteria ⁽³⁾	23MP01 S23GWMPM01 20070618 ORIGINAL	23MP01 FD-061807 20070618 DUPLICATE	23MP01 \$23GWMPM02 20070906 ORIGINAL	23MP01 S23GWMPM-03 20071218 ORIGINAL	23MP01 FD-121807-01 20071218 DUPLICATE	23MP01 S23GWMPM-04 20080221 ORIGINAL
Volatile Organics (μg/L)		***************************************	 						
BENZENE	710	130	NA T	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J
BROMODICHLOROMETHANE	NE	NE	NA NA	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROFORM	14100	26	NA NA	3 J	2 J	0.5 U	0.5 U	0.5 U	0.5 U
CYCLOHEXANE	NE	NE	NA NA	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U
CIS-1,2-DICHLOROETHENE	NE	830	NA NA	0.3 J	0.2 J	0.3 J	0.2 J	0.5 U	0.2 J
ISOPROPYLBENZENE	NE	2800	NA NA	0.1 J	0.09 J	0.1 J	0.5 U	0.5 UJ	0.5 U
METHYL TERT-BUTYL ETHER	NE	21000	NA NA	1	0.9	0.4 J	0.6	0.6	0.7
TETRACHLOROETHENE	88	340	NA NA	0.3 J	0.3 J	0.4 J	0.3 J	0.2 J	0.3 J
TRICHLOROETHENE	2340	27	NA NA	0.4 J	0.3 J	0.5 J	0.4 J	0.3 J	0.4 J
PAHs (μg/L)							<u> </u>		
1-METHYLNAPHTHALENE	NE NE	NE	NA NA	0.2 U	0.2 U	0.2 U	0.96 J	0.048 J	0.21 U
2-METHYLNAPHTHALENE	NE	NE	NA NA	0.17 J	0.16 J	0.2 U	1.1 J	0.2 UJ	0.21 UJ
4-NITROANILINE	NE	NE	NA NA	0.2 U	0.2 U	1 UJ	0.75 J	1.0 UR	1.0 UJ
ACENAPHTHENE	NE NE	NE	NA ·	0.2 U	0.2 U	0.2 U	0.83 J	0.029 J	0.21 U
ACENAPHTHYLENE	0.3	NE	NA NA	0.2 U	0.2 U	0.2 U	0.90 J	0.20 UJ	0.21 U
ANTHRACENE	1,100,000	NE	NA NA	0.2 U	0.2 U	0.2 U	0.92 J	0.20 UJ	0.21 U
BENZO(A)ANTHRACENE	0.3	NE	NA NA	0.07 U	0.07 U	0.041 U	1.0 J	0.042 UJ	0.045 U
BENZO(A)PYRENE	0.3	NE	NA NA	0.2 W	0.2 U	0,2 U	0.35 J	0.20 U	0.21 U
BENZO(B)FLUORANTHENE	0.3	NE	NA NA	0.08 U	0.08 U	0.075 U	0.64 J	0.078 UJ	0.082 U
BENZO(G,H,I)PERYLENE	NE	NE	NA NA	0.2 UJ	0.2 U	0.2 U	0.31	0.20 U	0.21 U
BENZO(K)FLUORANTHENE	0.3	NE	NA NA	0.2 UJ	0.2 UJ	0.2 U	0.53 J	0.20 U	0.21 U
CHRYSENE	NE	NE	NA NA	. 0.2 U	0.2 U	0.2 U	0.76 J	0.20 UJ	0.21 U
DIBENZO(A,H)ANTHRACENE	NE	NE	NA NA	0.2 UJ	0.2 U	0.2 U	0.14 J	0.20 U	0.21 U
FLUORANTHENE	3,700	NE	NA NA	0.2 U	0.2 U	0.2 U	1.1 J	0.20 UJ	0.21 U
FLUORENE	140,000	NE	NA NA	0.2 U	0.2 U	0.2 U	0.97 J	0.20 UJ	0.21 UJ
HEXACHLOROBENZENE	0.077	NE	NA NA	1 U	1 U	0.2 U	1.2 J	0.20 UJ	0.21 U
HEXACHLOROBUTADIENE	NE	. NE	NA NA	0.2 U	0.2 U	0.48 U	0.64 J	0.099 U	0.21 U
INDENO(1,2,3-CD)PYRENE	NE	NE	NA .	0.2 UJ	0.2 U	0.2 U	0.22	0.20 U	0.21 UJ
NAPHTHALENE	NE	NE	NA NA	0.2 U	0.2 U	0.2 U	1.0 J	0.088 J	0.21 U
PHENANTHRENE	0.3	NE	NA NA	0.2 U	0.2 U	0.2 U	0.98 J	0.20 UJ	0.21 U
PYRENE	110,000	NE	NA NA	0.2 U	0.2 U	0.2 U	0.84 J	0.20 UJ	0.21 U
PAHs, Filtered (μg/L)								**************************************	
1-METHYLNAPHTHALENE	NE	NE	NA .	NA NA	NA	NA NA	NA	NA NA	0.093 J
2-METHYLNAPHTHALENE	NE	NE	NA NA	NA	NA NA	NA NA	NA NA	NA NA	0.2 UJ
4-NITROANILINE	NE	NE	NA NA	NA NA	NA ·	· NA	NA NA	NA NA	1.0 UJ
ACENAPHTHENE	NE	NE	NA NA	NA .	NA .	NA NA	NA NA	NA NA	0.031 J
ACENAPHTHYLENE	0.3	NE	NA NA	NA NA	NA ·	NA NA	NA ·	NA NA	0.2 U
ANTHRACENE	1,100,000	NE	NA NA	NA NA	NA NA	NA NA	NA .	NA NA	0.2 U
BENZO(A)ANTHRACENE	0.3	NE	NA NA	NA	NA NA	NA NA	NA NA	NA NA	0.042 U

TABLE 3-1

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

	Surface Water	Residential	Stormwater	23MP01 \$23GWMPM01	23MP01 FD-061807	23MP01 \$23GWMPM02	23MP01 S23GWMPM-03	23MP01 FD-121807-01	23MP01 S23GWMPM-04
PARAMETER	Protection Criteria(1)	Volatilization Criteria ⁽²⁾	Discharge Permit Criteria ⁽³⁾	20070618 ORIGINAL	20070618 DUPLICATE	20070906 ORIGINAL	20071218 ORIGINAL	20071218 DUPLICATE	20080221 ORIGINAL
PAHs, Filtered (continued) (μg/L)		· · · · · · · · · · · · · · · · · · ·	. 			1 000000	- ONIONAL	DOLLIONIE	1 011011172
BENZO(A)PYRENE	0.3	NE	NA NA	,NA	NA NA	NA	NA NA	NA NA	0.2 U
BENZO(B)FLUORANTHENE	0.3	NE	NA NA	NA	NA NA	NA NA	NA	NA NA	0.078 U
BENZO(G,H,I)PERYLENE	NE	NE	NA NA	NA	NA NA	NA	NA NA	NA	0.13 J
BENZO(K)FLUORANTHENE	0.3	NE	NA NA	NA	. NA	NA NA	NA .	NA NA	0.2 U
CHRYSENE	NE NE	NE	NA NA	NA NA	NA NA	NA.	NA NA	NA	0.2 U
DIBENZO(A,H)ANTHRACENE	· NE	NE	NA	NA	NA NA	NA	NA	NA ·	0.2 U
FLUORANTHENE	3,700	NE	NA NA	NA	NA NA	NA .	NA NA	NA NA	0.2 U
FLUORENE	140,000	NE	NA NA	NA	NA NA	NA	NA NA	NA NA	0.2 UJ
HEXACHLOROBENZENE	0.077	NE	NA	NA	NA NA	NA	NA .	NA NA	0.2 U
HEXACHLOROBUTADIENE	NE	NE	NA NA	NA	NA NA	NA	NA NA	NA NA	0,2 ∪
INDENO(1,2,3-CD)PYRENE	NE	. NE	NA	NA	NA NA	NA	NA NA	NA	0.22 J
NAPHTHALENE	NE	NE	NA NA	NA NA	NA NA	NA NA	NA .	NA	0.069 J
PHENANTHRENE	0.3	NE	NA NA	NA	NA NA	NA	NA NA	NA NA	0.2 U
PYRENE	110,000	NE	NA .	NA	NA NA	NA NA	NA .	NA	0.2 U
inorganics, Total (μg/L)			·						
ALUMINUM	NE	NA NA	NA NA	473	115	322	38.1	21.8	. 29.4
ARSENIC	4	NA	NA -	3.7 U	3 U	13.9	2.2 U	4.7 U	3.1
BARIUM	NE	NA	NA NA	48.2	52.4	87	55.2	53.4	55.9
CALCIUM	NUT	NA NA	NA NA	33800	35800	32000	35,500	34,700	34,300
CHROMIUM	110 (4)	NA	NA NA	0.94 U	0.81 U	2	0.41	0.28 U	0.38 ∪
COBALT	NE	NA	NA .	0.84 U	0.64 U	0.26 U	0.66	0.53	0.6
COPPER	48	NA	60	- 3U	3 U	4.2	0.44 U	0.22 U	0.8 U
IRON	NUT	NA .	NA NA	9,190	11,900	70,800	9,860	10,200	4,380
LEAD	13	NA	30	2.2	9.3	8.4	2.5 U	2.2 U	1.4 ∪
MAGNESIUM	NUT	NA	NA NA	7,260	7660	7,020	7,660	7,490	7,450
MANGANESE	NE	NA	. NA	661	715	845	858	815	784
NICKEL	880	NA	NA NA	1.1 U	0.88 U	0.41 U	0.53	0.46	0.64
POTASSIUM	NUT	NA NA	NA NA	5210	5490	5,270	5,590	5,490	5,150
SELENIUM	50	NA	NA NA	1.5 U	2 J	1.5 U	1.5 U	1.5 U	2.2 U
SILVER	12	NA	NA NA	0.46 U	0.46 U	1.5	0.46 U	0.46 U	0.54 U
SODIUM	NUT	NA NA	NA NA	46,900	49,600	52,100	53,400	52,300	50,100
VANADIUM	NE	NA	NA NA	1.3 U	1.4 U	3.7	0.34 U	0.29 U	0.52 U
ZINC	123	NA .	200	21.3 J	22.3	47.1	22.8	20.0	26.6
Inorganics, Filtered (μg/L)									
ALUMINUM	NE	NA NA	NA NA	20.4 J	36.7 J	21.3 J	19.0 U	19.0 U	35.4
ARSENIC	4	NA NA	NA NA	3.5 U	2.2 U	1,2 J	1.9 U	1.1 U	2.8
BARIUM	NE	NA .	NA NA	44.6	46.4	50.1	48.9	49.6	56.8
CALCIUM	NUT	NA	NA NA	33,600	34,700	31,400	33,100	33,400	36,000
CHROMIUM	110 (4)	NA .	NA NA	1.2 U	0.44 U	0.3 J	0.29	0.48	0.38 U
COBALT	NE	NA NA	NA NA	0.67 U	0.86 U	0.47 J	0.48	0.51	0.64
IRON	NUT	NA	NA NA	3,470	3,630	3,600	4,190	4,140	3,750

TABLE 3-1

SUMMARY OF POSITIVE DETECTIONS FOR YEAR 1 MONITORING EVENTS SITE 23 UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 3 OF 3

PARAMETER	Surface Water Protection Criteria ⁽¹⁾	Residential Volatilization Criteria ⁽²⁾	Stormwater Discharge Permit Criteria ⁽³⁾	23MP01 S23GWMPM01 20070618 ORIGINAL	23MP01 FD-061807 20070618 DUPLICATE	23MP01 823GWMPM02 20070906 ORIGINAL	23MP01 S23GWMPM-03 20071218	23MP01 FD-121807-01 20071218	23MP01 S23GWMPM-04 20080221
Inorganics, Filtered (continued) (μg/L)					DOFLICATE	URIGINAL	ORIGINAL	DUPLICATE	ORIGINAL
AD	13	NA	30	1.3 J	1.8 J	1			<u></u>
AGNESIUM	NUT	NA NA	NA NA	7,200		1,1 U	2.1 U	2.8 U	1.4 U
NGANESE	NE	NA	NA NA		7,480	6,980	7,250	7,300	8,020
CKEL	880	NA NA		645	664	708	764	770	815
TASSIUM	NUT		NA ·	1.1 U	0.88 U	0.78 J	1.0	0.64	0.66
LENIUM	50	NA NA	NA NA	5,090	5,390	5,320	5,360	5,390	5,390
DIUM		NA NA	NA NA	1.5 U	1.7 J	2.4 U	1.5 U	2.3 U	2.2 U
IC .	NUT	NA NA	NA NA	46,600	48,400	52,600	50,400	51,400	52.100
	123	NA .	200	21.4 J	19.5 J	15	18.6	20.8	26
roleum Hydrocarbons (µg/L)						<u> </u>		20.0	20
ETPH (C09-C36)	NE	NE	2500 ⁽⁵⁾	55 J	79 U	140 J	160 U		
roleum Hydrocarbons, Filtered (µg/L)						1403	160 0	1600 J	75 ∪
ETPH (C09-C36)	NE NE	NE	2500 ⁽⁵⁾	NA I	NA I			<u> </u>	
Connecticut Remediation Standard Regulations Proposed Revisions to Connecticut's Remediat			2000	iva.	, NA J	NA	NA .	NA	75 U

ATTACHMENT A.5 RISKS BASED ON QUARTERLY UNDERDRAIN METERING PIT SAMPING RESULTS

TABLE 2.1 OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 4

Scenario Timeframe: Medium: Groundwater Exposure Medium: Groundwater

cposure Point	CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Maximum Concentration ⁽¹⁾	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Concentrations ⁽⁴⁾	Screening Toxicity Value ⁽⁵⁾	Potential ARAR/TBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminan Deletion or
Site 23		ganic Compounds			<u> </u>	<u> </u>					<u> </u>		Source	لـــــا	Selection ⁽⁶⁾
	/1-43-2	Benzene	0.2 J	0.2 J	ug/L	S23GWMPM04	1/4	0.5 - 0.5	0.2	NA NA	0.35 C	1	CTDEP RSR	No I	BSL
				į į	1		1	1	i			5	FED-MCL	"	DOL
	75-27-4	Bromodichloromethane	0.3 J	0.3 J	ug/L	S23GWMPM01	1/4	0.5 - 0.5	0.3	NA NA		5	CTDEP-MCL		
					-	1	"-	0.5 - 0.5	0.3	NA.	0.18 C	0.56 80	CTDEP RSR FED-MCL	Yes	ASL
	67-66-3	Chloroform	2 J	3 J						İ		80	CTDEP-MCL	1 1	
1			- 23	3 J	ug/L	S23GWMPM01	1/4	0.5 - 0.5	3	NA NA	0.17 C	6	CTDEP RSR	Yes	ASL
ļ		<u> </u>				· ·	i				•	80	FED-MCL		
	156-59-2	cis-1,2-Dichloroethene	0.2 J	0.3 J	ug/L	S23GWMPM01	4/4	0.5 - 0.5	0.3	NA .	6.1 N	80 70	CTDEP-MCL CTDEP RSR	No	BSL
			1.			S23GWMPM02	i			, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	. 0.714	70	FED-MCL	140	BSL
ı	110-82-7	Cyclohexane	0.1 J	0.1 J	ug/L	S23GWMPM02	474	0.50.5				70	CTDEP-MCL		
1				0.70	ugre	323GVVIVIPIVIUZ	1/4	0.5 - 0.5	0.1	NA	1000 N	NA	NA	No	NTX
ŀ	98-82-8	1					ľ	1 [NA NA	NA NA		
l	90-02-8	Isopropyibenzene	0.09 J	0.1 J	ug/L	S23GWMPM01	2/4	0.5 - 0.5	0.1	NA NA	66 N	30	CTDEP RSR	No	BSL
1						S23GWMPM02		! !		•		NA	NA NA		USL
Ī	1634-04-4	Methyl Tert-Butyl Ether	0.4 J	1	ug/L	\$23GWMPM01	4/4	 	1			NA NA	NA .		
					-5-=	020077777	7/7		'	NA NA	11 C	70	CTDEP RSR	No	BSL
F	127.19.4	Tetrachloroethene						ĺ			. 1	NA NA	NA NA		
ł	127-10-4	retrachioroethene	0.2 J	0.4 J	ug/L	S23GWMPM02	4/4	- :	0.4	NA	0.1 C	5	CTDEP RSR	Yes	ASL
. [1			,						5	FED-MCL		
	79-01-6	Trichtoroethene	0.3 J	0.5 J	ug/L	S23GWMPM02	4/4		0.5	NA NA	0.000.0	5	CTDEP-MCL		
			1	!			,-,-	_	0.3	IVA .	0.028 C	5 .	CTDEP RSR FED-MCL	Yes	ASL
h	PAHs	<u> </u>										5	CTDEP-MCL		
· ř		1-Methylnaphthalene	0.048 J	0.96 J		000000000000000000000000000000000000000							O.DE. MOE		-
1		7.11.1310	0.0483	0.96.1	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.96	NA	0.62 N ^(/)	49	CTDEP RSR	Yes	ASL
<u> </u>									1	5	J	NA	NA		
	91-57-6	2-Methylnaphthalene	0.16 J	1.1 J	ug/L	S23GWMPM-03	2/4	0.2 - 0.21	1.1	NA .	0.62 N ^(/)	NA 49	NA CTDEP RSR		
- 1			1								0.02 1	NA I	NA NA	Yes	ASL
	100-01-6	4-Nitroaniline	0.75 J	0.75 J	ug/L	S23GWMPM-03	- 400					NA	NA .		
				0.750	ugic	323GVVIVIPIN-U3	1/4	0.2 - 1	0.75	NA	3.2 C		CTDEP RSR	No	BSL
. }-	83-32-9								·		-	NA NA	NA NA	1	
i	03-32-9	Acenaphthene	0.029 J	0.83 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.83	NA NA	37 N	NA NA	NA NA	No	BSL
				1		1		1				NA	NA I	110	DOL
	208-96-8	Acenaphthylene	0.9 J	0.9 J	ug/L	S23GWMPM-03	1/4	22 221				NA	NA NA		
]	0.00	ug/L	323GVVWFW-03	1/4	0.2 - 0.21	0.9	NA NA	37 N ⁽⁸⁾		CTDEP RSR	No	BSL
⊢	120-12-7	Aashaa							1			NA NA	NA NA	- 1	
· i	120-12-7	Anthracene	0.92 J	0.92 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.92	NA NA	180 N		CTDEP RSR	No	BSL
				1	- 1	}		ľ		İ		NA	NA		DOL
Γ	56-55-3	Benzo(a)anthracene	1 J	13	ug/L	S23GWMPM-03	1/4	0.041 - 0.07	1	NA NA		NA	NA .		
.		-	1 1	J			"7	0.041 - 0.07	' 1	. NA	0.092 C	0.06 NA	CTDEP RSR NA	Yes	ASL
-	50-32-8	Benzo(a)pyrene	0.35 J								1	NA I	NA NA	1	
1	10.02.0	DENZO(A)DYTENE	0.35 J	0.35 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.35	NA .	0.0092 C	0.2	CTDEP RSR	Yes	ASL
]									0.2	FED-MCL		
	205-99-2	Benzo(b)fluoranthene	0.64 J	0.64 J	ug/L	S23GWMPM-03	1/4	0.075 - 0.082	0.64	NA NA	0.092 C		CTDEP-MCL		
	•	-		.	-	·			1	,*^	0.092 C	0.08 NA	NA NA	Yes	ASL
⊢	191-24-2	Benzo(g,h,i)perylene	 								[NA I	NA I		
-		oenzo(g,n,nperylene	0.31	0.31	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.31	NA	18 N ⁽⁹⁾	NA	NA	No	BSL
							. 1	j				NA	NA .		
	207-08-9	Benzo(k)fluoranthene	0.53 J	0.53 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.53	NA NA	0.92 C	NA 0.5	NA CTDEP RSR		
Γ								V.M.	0.00	13075 1	U.92 C	0.5	00 00 12 12 15 15 15 15 15 15 15 15 15 15 15 15 15	Yes	ASL
ſ			1	1	1	. 1	- 1			i		NA I	NA	-50	AGE

TABLE 2.1 OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 4

Scenario Timeframe: Medium: Groundwater Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Maximum Concentration ⁽¹⁾	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Concentrations ⁽⁴⁾	Screening Toxicity Value ⁽⁵⁾	Potential ARAR/TBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
	218-01-9	Chrysene	0.76 J	0.76 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.76	NA	9.2 C	4.8 NA NA	CTDEP RSR NA NA	No	BSL
	53-70-3	Dibenzo(a,h)anthracene	0.14 J	0.14 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.14	NA :	0.0029 C	0.2 NA NA	CTDEP RSR NA NA	Yes	ASL
	206-44-0	Fluoranthene	1.1 J	1.1 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	1,1	NA NA	150 N	280 NA NA	CTDEP RSR NA NA	No	BSL
	86-73-7	Fluorene	0.97 J	0.97 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.97	NA .	24 N	280 NA	CTDEP RSR NA	No	BSL
	118-74-1	Hexachlorobenzene	1.2 J	1.2 J	ug/L	S23GWMPM-03	1/4	0.2 - 1	1.2	NA NA	0.042 C	NA 1	NA CTDEP RSR FED-MCL	Yes	ASL
	87-68-3	Hexachlorobutadiene	0.64 J	0.64 J	ug/L	S23GWMPM-03	1/4	0.099 - 0.48	0.64	NA NA	0.86 C	1 49 NA	CTDEP-MCL CTDEP RSR NA	No	B SL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.22	0.22	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.22	NA NA	0.092 C	50 0.5 NA	CTDEP-MCL CTDEP RSR NA	Yes	ASL
	91-20-3	Naphthalene	0.088 J	1 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	: 1	NA .	0.62 N	NA 280 NA NA	NA CTDEP RSR NA NA	Yes	ASL
	85-01-8	Phenanthrene	0.98 J	0.98 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.98	NA .	18 N ⁽⁹⁾	200 NA NA	CTDEP RSR NA NA	No	BSL
	129-00-0	Pyrene	0.84 J	0.84 J	ug/L	S23GWMPM-03	1/4	0.2 - 0.21	0.84	NA NA	18 N	200 NA NA	CTDEP RSR NA NA	No	BSL
	PAHs, Filter	red		L		<u> </u>								·	
		1-Methylnaphthalene	0.093 J	0.093 J	ug/L	S23GWMPM04	1/1	•	0.093	NA NA	0.62 N ⁽⁷⁾	49 ⁽¹⁰⁾ NA NA	CTDEP RSR NA NA	No	BSL
	83-32-9	Acenaphthene	0.031 J	0.031 J	ug/L	S23GWMPM04	1/1	•	0.031	NA NA	37 N	NA NA NA	NA NA NA	No	BSL
	191-24-2	Benzo(g,h,i)perylene	0.13 J	0.13 J	ug/L	S23GWMPM04	1/1	-	0.13	NA .	18 N ⁽⁹⁾	NA NA NA	NA NA NA	No :	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.22 J	0.22 J	ug/L	S23GWMPM04	1/1	- · · · ·	0.22	. NA	0.092 C	0.5 NA NA	CTDEP RSR NA NA	Yes	ASL
	91-20-3	Naphthalene	0.069 J	0.069 1	ug/L	S23GWMPM04	1/1	•	0.069	NA .	0.62 N	280 NA NA	CTDEP RSR NA NA	No	BSL
	Inorganics	·							473	3560	3600 N	NA.	l NA	Yes	ASL
		Aluminum	21.8	473	ug/L	S23GWMPM01	4/4	-				50 NA	FED-SMCL NA		
	7440-38-2	Arsenic	3.1	13.9	ug/L	S23GWMPM02	2/4	2.2 - 4.7	13.9	1.92	0.045 C	50 10 10	CTDEP RSR FED-MCL CTDEP-MCL		ASL
	7440-39-3	Barium	48.2	87	ug/L	S23GWMPM02	4/4		87	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	No	BSL
•	7440-70-2	Calcium	32000	35800	ug/L	S23GWMPM01-D	4/4	•	35800	188000	NA	NA NA NA	NA NA NA	No	NUT
	15723-28-1	Chromium	0.41	2	ug/L	S23GWMPM02	2/4	0.28 - 0.94	2	49.9	11 N ⁽¹¹⁾	50 100 100	CTDEP RSR FED-MCL CTDEP-MCL	No	BSL

TABLE 2.1 OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT PAGE 3 OF 4

Scenario Timeframe: Medium: Groundwater Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Maximum Concentration ⁽¹⁾	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Concentrations ⁽⁴⁾	Screening Toxicity Value ⁽⁵⁾	Potential ARAR/TBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
	7440-48-4		0.53	0.66	ug/L	S23GWMPM-03	2/4	0.26 - 0.84	0.66	48.6	73 N	NA NA NA	NA NA NA	No	BSL
	7440-50-8	Copper	4.2	4.2	ug/L	S23GWMPM02	1/4	0.22 - 3	4.2	107	150 N	1300 1300 1300	FED-MCL CTDEP-MCL	No	BSL
	7439-89-6	Iron	4380	70800	ug/L	S23GWMPM02	4/4		70800	28200	1100 N	NA 300 NA	CTDEP RSR FED-SMCL CTDEP-MCL	Yes	ASL
	7439-92-1	Lead	2.2	9.3	ug/L	S23GWMPM01-D	2/4	1.4 - 2.5	9.3	6.63	NA NA	15 15 15	CTDEP-MCL CTDEP-MCL CTDEP-MCL	No	BSL
	7439-95-4	Magnesium	7020	7660	ug/L	S23GWMPM01-D S23GWMPM-03	4/4	•	7660	191000	NA NA	NA NA	NA NA	No	NUT
	7439-96-5	Manganese	661	858	ug/L	S23GWMPM-03	4/4	•	858	11700	88 N	NA NA 50	NA NA FED-SMCL	Yes	ASL
	7440-02-0	Nickel	0.46	0.64	ug/L	S23GWMPM04	2/4	0.41 - 1	0.64	32.2	73 N	NA 100 NA	NA CTDEP RSR NA	No	BSL
,	7440-09-7	Potassium	5150	5590	ug/L	\$23GWMPM-03	4/4	÷	5590	70800	NA NA	NA NA	NA NA	No No	NUT
,	7782-49-2	Selenium	2 J	2 J	ug/L	S23GWMPM01-D	1/4	1.5 - 2.2	2	3.19	18 N	50 50	NA CTDEP RSR FED-MCL	No	BSL
	7440-22-4	Silver	1.5	1.5	ug/L	S23GWMPM02	1/4.	0.46 - 0.54	1.5	NA NA	18 N	50 36 100	NA FED-SMCL	No	BSL
	7440-23-5	Sodium	46900	53400	ug/L	S23GWMPM-03	4/4	•	53400	1900000	NA NA	NA NA NA	NA NA NA	No	NUT
	7440-62-2	Vanadium	3.7	3.7	ug/L	S23GWMPM02	1/4	0.29 - 1.4	3.7	10.2	3.6 N	50 NA NA	NA CTDEP RSR NA NA	Yes	ASL
	7440-66-6	Zinc	20 J	47.1	ug/L	\$23GWMPM02	4/4	-	47.1	131	1100 N	5000 NA NA	CTDEP RSR NA NA	No	BSL
	Inorganics,	Filtered	· · · · · · · · · · · · · · · · · · ·				لـــــــــــــــــــــــــــــــــــــ				L	N/A	1 194		
	7429-90-5	Aluminum	20.4 J	36.7 J	ug/L	S23GWMPM01-D	3/4	19 - 19	36.7	64.4	3600 N	NA 50 NA	NA FED-SMCL NA	No	BSL
•	7440-38-2	Arsenic	1.2 J	2.8	ug/L	S23GWMPM04	2/4	1.1 - 3.5	2.8	2.55	0.045 C	50 10 10	CTDEP RSR FED-MCL CTDEP-MCL	Yes	ASL
•	7440-39-3	Barium	44.6	56.8	ug/L	S23GWMPM04	4/4	-	56.8	124	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	No .	BSL
	7440-70-2	Calcium	31400	36000	ug/L	S23GWMPM04	4/4		36000	152000	NA	NA NA NA	NA NA NA	No	NUT
	15723-28-1	Chromium	0.29 J	0.48	ug/L	S23GWMPM-03-D	2/4	0.38 - 1.2	0.48	16	11 N ⁽¹¹⁾	50 100 100	CTDEP RSR FED-MCL CTDEP-MCL	No	BSL
	7440-48-4		0.47 J	0.64	ug/L	S23GWMPM04	3/4	0.67 - 0.86	0.64	43.3	73 N	NA NA NA	NA NA NA	Nó	BSL
	7439-89-6	Iron	3470	4190	ug/L	S23GWMPM-03	4/4	•	4190	25300	1100 N	NA 300 NA	NA FED-SMCL	Yes	ASL

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT

PAGE 4 OF 4

Scenario Timeframe: Medium: Groundwater Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Maximum Concentration ⁽¹⁾	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Concentrations ⁽⁴⁾	Screening Toxicity Value ⁽⁵⁾	Potential ARAR/TBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
	7439-92-1	Lead	1.3 J	1.8 J	ug/L	S23GWMPM01-D	1/4	1.1 - 2.8	1.8	2.52	NA	15 15 15	CTDEP RSR FED-MCL CTDEP-MCL	No	BSL
	7439-95-4	Magnesium	6980	8020	ug/L	S23GWMPM04	4/4	•	8020	150000	NA NA	NA NA NA	NA NA NA	No	NUT
	7439-96-5	Manganese	645	815	ug/L	S23GWMPM04	4/4	•	815	9400	88 N	NA 50 NA	NA FED-SMCL NA	Yes	ASL
	7440-02-0	Nickel	0.64 J	1	ug/L	S23GWMPM-03	3/4	0.88 - 1.1	1	15.3	73 N	100 NA 100	NA NA NA	No	BSL
•	7440-09-7	Potassium	5090	5390	ug/L	S23GWMPM01-D S23GWMPM-03-D S23GWMPM04	4/4	•	5390	60000	NA NA	NA NA NA	NA NA NA	No	NUT
	7782-49-2	Selenium	1.7 J	1.7 J	ug/L	S23GWMPM01-D	1/4	1.5 - 2.4	1.7	NA.	18 N	50 50 50	CTDEP RSR FED-MCL CTDEP-MCL	No	BSL
	7440-23-5	Sodium	46600	52600	ug/L	S23GWMPM02	4/4	•	52600	1580000	NA	NA NA NA	NA NA NA	No	NUT
	7440-66-6	Zinc	15 J	26	ug/L	S23GWMPM04	4/4	-	26	109	1100 N	5000 NA NA	CTDEP RSR NA NA	No	BSL
		lydrocarbons					D 6/4	75 400	4600		I NA	500	CTDEP RSR	Yes	ASL
		Totał Petroleum Hydrocarbons	55 J	1600 J	ug/L	S23GWMPM-03-D	3/4	75 - 160	1600	NA .	NA	NA NA	NA NA	res	AGL

Footnotes:

- 1 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 Values are from the Basewide Groundwater Operable Unit Remedial Investigation Report (Tetra Tech, January 2002).
- 5 USEPA Region IX Preliminary Remediation Goal (PRG). The noncarcinogenic values (denoted with a "N" flag) are the PRG divided by 10 to correspond 5 - USEPA Region IX Preinfilingly Remediation Goal (PRG). The honoractinggenic values (denoted with a "Nagy are the PRG divided by 16 to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (USEPA Region IX, October 2004, Updated December 28, 2004).
 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
- 7 Naphthalene is used as a surrogate for 1- and 2-methylnaphthalene.
- 8- Acenaphthene is used as a surrogate for acenaphthylene.
- 9 Pyrene is used as a surrogate for benzo(g.h,i)perylene and phenanthrene.
- 10 2-methylnaphthalene is used as a surrogate for 1-methylnaphthalene.
- 11 Value is for hexavalent chromium.

Shaded criterion indicates that the maximum detected concentration exceeds one or more screening criteria. Shaded chemical name indicates that the chemical was retained as a COPC.

Associated Samples S23GWMPM01 S23GWMPM01-D S23GWMPM02

\$23GWMPM-03 S23GWMPM-03-D

S23GWMPM04

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirements To Be Considered

C = Carcinogen
COPC = Chemical Of Potential Concern

J = Estimated value

N = Noncarcinogen

NA = Not Applicable/Not Available

FED-MCL = Federal Maximum Contaminant Level (USEPA, 2006) FED-SMCL = Federal Maximum Contaminant Level (USEPA, 2006)

CTDEP-RSR = Connecticut DEP Remediation Standard Regulations, 1996.

CTDEP-MCL = Connecticut DEP Maximum Contaminant Level.

Rationale Codes:

For selection as a COPC:

ASL = Above Screening Level/ARAR/TBC

For elimination as a COPC:

BSL = Below COPC Screening Level

NUT = Essential nutrient

NTX = No toxicity criteria

EPA1 = USEPA Region 1 does not advocate evaluation of this chemical

TABLE 3.1.RME EXPOSURE POINT CONCENTRATION SUMMARY REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Current/Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point	Chemical of	Units	Arithmetic	95% UCL	Maximum Concentration		Ex	posure Point Concentration	
	Potential Concern	}	Mean	(Distribution)	(Qualifier)	Value	Units	Statistic	Rationale
Site 23	Bromodichloromethane	ug/L	0.26	(1)	0.3 J	0.3	ug/L	Maximum Detected Concentration	(2)
	Chloroform	ug/L	0.81	(1)	3 J	2.5	ug/L	Maximum Detected Concentration	(2,3)
	Tetrachloroethene	ug/L	0.31	(1)	0.4 J	0.4	ug/L	Maximum Detected Concentration	(2)
	Trichloroethene	ug/L	0.40	(1)	0.5 J	0.5	ug/L	Maximum Detected Concentration	(2)
	1-Methylnaphthalene	ug/L	0.20	(1)	0.96 J	0.492	ug/L	Maximum Detected Concentration	(2,3)
	2-Methylnaphthalene	ug/L	0.24	(1)	1.1 J	0.6	ug/L	Maximum Detected Concentration	(2,3)
	Benzo(a)anthracene	ug/L	0.15	(1)	1 J	0.51	ug/L	Maximum Detected Concentration	(2,3)
	Benzo(a)pyrene	ug/L	0.13	(1)	0.35 J	0.225	ug/L	Maximum Detected Concentration	(2,3)
	Benzo(b)fluoranthene	ug/L	0.11	(1)	0.64 J	0.3395	ug/L	Maximum Detected Concentration	(2,3)
	Benzo(k)fluoranthene	ug/L	0.16	(1)	0.53 J	0.315	ug/L	Maximum Detected Concentration	(2,3)
	Dibenzo(a,h)anthracene	ug/L	0.11	(1)	0.14 J	0.12	ug/L	Maximum Detected Concentration	(2,3)
	Hexachlorobenzene	ug/L	0.34	(1)	1.2 J	0.65	ug/L	Maximum Detected Concentration	(2,3)
	Indeno(1,2,3-cd)pyrene	ug/L	0.12	(1)	0.22	0.16	ug/L	Maximum Detected Concentration	(2,3)
	Naphthalene	ug/L	0.21	(1)	1 J	0.552	ug/L	Maximum Detected Concentration	(2,3)
	Aluminum	ug/L	169	(1)	473	322	ug/L	Maximum Detected Concentration	(2,3)
	Arsenic	ug/L	5.1	(1)	13.9	13.9	ug/L	Maximum Detected Concentration	(2)
	Iron	ug/L	23939	(1)	70800	70800	ug/L	Maximum Detected Concentration	(2)
	Manganese	ug/L	788	(1)	858	845	ug/L	Maximum Detected Concentration	(2,3)
	Vanadium	ug/L	1.2	(1)	3.7	3.7	ug/L	Maximum Detected Concentration	(2)

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

J - Estimated value.

^{1 -} There were an insufficent number of samples to calculate distribution statistics.

^{2 -} There were only four rounds of results which is insufficient to calculate a temporal average, therefore the maximum detected concentration is used as the exposure point concentration.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Workers	Adult	Site 23	Daevent	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermally Absorbed Dose (mg/kg/day) =
				SA	Skin Surface Available for Contact	3300	cm2	U.S. EPA, 2004	
		*		EV.	Event Frequency	1	events/day	(1)	DAevent x EV x EF x ED x SA
				ET	Exposure Time	4.	hours/day	(1) .	BW x AT
	·			EF	Exposure Frequency	30	days/year	(1)	
	i			ED	Exposure Duration	1	years	(1)	See text for calculation of DAevent.
		**		BW	Body Weight	. 70	· kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	<u> </u>

Sources:

- 1 Professional judgment.
- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion intake = (IR-GW x EF x ED)/(BW x AT)

Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake = NA

Cancer Dermai Intake = 5.54E-02

Noncancer Ingestion Intake = NA

Noncancer Dermal Intake = 3.87E+00

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Construction Workers	Adult	Site 23	CA	Chemical concentration in air	Calculated	mg/m3	VDEQ, 2004	Intake (mg/kg/day) =
		:*	1	CW	Chemical concentration in water.	Average	ug/L		
				CF	Conversion Factor	0.001	mg/ug		CA x IR x ET x EF x ED
				IR	Inhalation Rate	2.5	m3/hour	U.S. EPA, 1993	BW x AT
				ET	Exposure Time	4	hours/day	(1)	
· .			•	EF	Exposure Frequency	30	days/year	(1)	CA = CW x CF x VF
		,	·	ED	Exposure Duration	1	years	(1)	
			+	BW	Body Weight	70	kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	
				VF	Volatilization Factor	Calculated	(mg/m3)/(mg/L)	VDEQ, 2004	

Notes:

- 1 Professional judgment.
- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
- VDEQ, 2004: Virginia Department of Environmental Quality (VDEQ, online- http://www.deq.state.va.us/vrprisk/homepage.html).

Unit Intake Calculations

Inhalation Intake = (IR x ET x EF x ED)/(BW x AT)

Cancer Inhalation Intake = 1.68E-04

Noncancer Inhalation Intake = 1,17E-02

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Child	Site 23	CGW	Chemical Concentration in Groundwater	Max or 95% UCL	mg/kg	U.S. EPA, 2002a	Chronic Daily Intake (CDI) (mg/kg/day) =
		!	1.	CF	Conversion Factor	0.001	mg/ug	-	
				IR-GW	Ingestion Rate of Groundwater	1.5	L/day	U.S. EPA, 1994	CW x CF x IR-GW x EF x ED
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	BW x AT
· ·			·	ED1	Exposure Duration (Age 0 - 2)	2	years	U.S. EPA, 1989	
				ED2	Exposure Duration (Age 2 - 6)	4 /	years	U.S. EPA, 1989	
					Body Weight	15	kg	U.S. EPA, 1991	
	·			AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	U.S. EPA, 1989	
Dermal	Residents	Child	Site 23	Daevent	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermally Absorbed Dose (mg/kg/day) =
				SA	Skin Surface Available for Contact	6,600	cm2	U.S. EPA, 2004	
				EV	Event Frequency	1	events/day	U.S. EPA, 2004	DAevent x EV x EF x ED x SA
-				ET	Exposure Time	0.25	hours/day	U,S. EPA, 1997	BW x AT
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	
				ED1	Exposure Duration (Age 0 - 2)	2	years	U.S. EPA, 1989	See text for calculation of DAevent.
			,	ED2	Exposure Duration (Age 2 - 6)	4	years	U.S. EPA, 1989	
				BW	Body Weight	15	kg	U.S. EPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	U.S. EPA, 1989	1

Sources:

- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1; Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 1991: Risk Assessment Guidance for Superfund Supplemental Guidance- Standard Default Exposure Factors Interim Final.
- U.S. EPA, 1994; U.S. EPA Region I Risk Updates, August 1994.
- U.S. EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa
- U.S. EPA, 2002:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.
- U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion Intake = (IR-GW x EF x ED)/(BW x AT)

Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake (Age 0 - 2) = 2.74E-06Cancer Ingestion Intake (Age 2 - 6) = 5.48E-06 Cancer Dermal Intake (Age 0 - 2) = 1.21E+01 Cancer Dermal Intake (Age 2 - 6) = 2.41E+01

Noncancer Ingestion Intake = 9.59E-05

Noncancer Dermal Intake = 4.22E+02

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Adult	Site 23	CGW	Chemical Concentration in Groundwater	95% UCL or Max	ug/L	U.S. EPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug	 '	
				IR-GW	Ingestion Rate of Groundwater	2	L/day	U.S. EPA, 1994	CW x CF x IR-GW x EF x ED
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	BW x AT
				ED1	Exposure Duration (Age 10 - 16)	10	years	U.S. EPA, 1989	
				ED2	Exposure Duration (Age 16 - 30)	14	years	U.S. EPA, 1989	
				BW	Body Weight	70	kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25,550	days	U.S. EPA, 1989	* .
				AT-N	Averaging Time (Non-Cancer)	3,650	days	U.S. EPA, 1989	
Dermal	Residents	Adult	Site 23	Daevent	Dermally Absorbed Dose per Event	Calculated	mg/cm2-event	U.S. EPA, 2004	Dermally Absorbed Dose (mg/kg/day) =
1.0				SA	Skin Surface Available for Contact	18,000	cm2	U.S. EPA, 2004	
				ΕV	Event Frequency	. 1	events/day	U.S. EPA, 2004	DAevent x EV x EF x ED x SA
				ET	Exposure Time	0.25	hours/day	U.S. EPA, 2004	BW x AT
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1994	
				ED1	Exposure Duration (Age 10 - 16)	10	years	U.S. EPA, 1989	See text for calculation of DAevent.
			*	ED2	Exposure Duration (Age 16 - 30)	14	years	U.S. EPA, 1989	
	2.5			BW	Body Weight	70 .	kg	U.S. EPA, 1989	
				AT-C	Averaging Time (Cancer)	25,550	days	U.S. EPA, 1989	•
				AT-N	Averaging Time (Non-Cancer)	3,650	days	U.S. EPA, 1989	

Sources:

- U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.
- U.S. EPA, 1991; Risk Assessment Guidance for Superfund Supplemental Guidance- Standard Default Exposure Factors Interim Final.
- U.S. EPA, 1994; U.S. EPA Region I Risk Updates, August 1994.
- U.S. EPA, 1997: Exposure Factors Handbook, U.S. EPA/600/8-95/002FA.
- U.S. EPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.
- U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Ingestion Intake = (IR-GW x EF x ED)/(BW x AT)

Dermal Intake = (SA x EV x EF x ED)/(BW x AT)

Cancer Ingestion Intake Age 10 - 16) = 3.91E-06

Cancer Dermal Intake Age 10 - 16) = 3.52E+01

Cancer Ingestion Intake Age 16 - 30) = 5.48E-06

Cancer Dermal Intake (Age 16 - 30) = 4.93E+01

Noncancer Ingestion Intake = 6.58E-05

Noncancer Dermai Intake = 5.92E+02

TABLE 4.5 INTERMEDIATE VARIABLES FOR CALCULATING DA(EVENT) SITE 23 - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

Chemical of	Media	Dermal Absorption	FA	K	(p	T(e)	/ent)	Та	ıu	ĭ	*	В
Potential Concern	l'	Fraction (soil)	Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
Volatile Organic Compounds												
Bromodichloromethane	Groundwater	NA .	1	4.6E-03	cm/hr	(1)	hr	8.8E-01	hr	2.1E+00	hr	2.3E-02
Chloroform	Groundwater	NA NA	1	6.8E-03	cm/hr	(1)	hr	5.0E-01	hr	1.2E+00	hr	2.9E-02
Tetrachloroethene	Groundwater	NA NA	1	3.3E-02	cm/hr	(1)	hr	9.1E-01	hr	2.2E+00	hr	1.7E-01
Trichloroethene	Groundwater	NA NA	1	1.2E-02	cm/hr	(1)	hr	5.8E-01	hr	1.4E+00	hr	5.1E-02
Semivolatile Organic Compou	unds											
1-Methylnaphthalene	Groundwater	NA NA	1	9.1E-02	cm/hr	(1)	hr	6.6E-01	hr	1.6E+00	hr	4.2E-01
2-Methylnaphthalene	Groundwater	NA .	1	8.9E-02	cm/hr	(1)	hr	6.6E-01	hr	1.6E+00	hr	4.1E-01
Benzo(a)anthracene ⁽²⁾	Groundwater	NA NA	. NA	NA	NA	NA	NA	NA.	NA	NA	NA	NA
Benzo(a)pyrene ⁽²⁾	Groundwater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene(2)	Groundwater	NA NA	NA	NA	NA.	NA	NA	, NA	NA	NA	NA	NA
Benzo(k)fluoranthene(2)	Groundwater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene(2)	Groundwater	NA NA	NA	NA	NA	NA	NA	NA	NA	NA NA	NA	NA
Hexachlorobenzene	Groundwater	NA NA	0.9	1.3E-01	cm/hr	(1)	hr	4.2E+00	hr	1.6E+01	hr	8.7E-01
Indeno(1,2,3-cd)pyrene ⁽²⁾	Groundwater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Groundwater	NA NA	1	4.7E-02	cm/hr	(1)	hr	5.6E-01	hr	1.3E+00	hr	2.0E-01
Inorganics				1.								
Aluminum	Groundwater	NA NA	1	1.0E-03	- cm/hr	(1)	hr	NA	NA	NA	NA	NA
Arsenic	Groundwater	NA NA	1	1.0E-03	cm/hr	(1)	hr	NA	NA	NA	NA	NA
Iron	Groundwater	NA	1	1.0E-03	cm/hr	(1)	hr	NA	NA	NA	NA	NA
Manganese	Groundwater	NA NA	1	1.0E-03	cm/hr	(1)	hr	NA	NA	NA	NA	NA
Vanadium	Groundwater	NA NA	. 1	1.0E-03	cm/hr	(1)	hr	NA .	NA	NA	NA	NA

Notes:

All values from EPA's Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, July 2004.

- 1 T_{event} is 4 hours for the construction worker and 0.25 hours for the child and adult resident.
- 2 RAGS Part E recommends that dermal exposures to PAHs in water should not be quantitatively evaluated in the risk assessment.

FA = Fraction Absorbed Water

Kp = Dermal Permeability Coefficient of Compound in Water

T(event) = Event Duration

Tau = Lag Time

T* = Time to Reach Steady-State

B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the

Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

NA = Not applicable.

TABLE 5.1 NON-CANCER TOXICITY DATA -- ORAL/DERMAL SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Chronic/ Subchronic		al RfD	Oral Absorption Efficiency	Absorbed Ri	D for Dermal ⁽²⁾	Primary Target	Combined Uncertainty/Modifying	RfD:Targ	et Organ(s)
Concern		Value	Units	for Dermal ⁽¹⁾	Value	Units	Organ(s)	Factors	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compound	S									
3romodichloromethane	Chronic	2.0E-01	mg/kg/day	1	2.0E-01	mg/kg/day	Kidney	1000/1	IRS	4/24/2008
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	100/1	IRS	4/24/2008
Tetrachloroethene	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000/1	IRS	4/24/2008
Trichloroethene	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Liver, Kidney	NA NA	USEPA(1)	8/2001
Semivolatile Organic Compo	ounds					·			······································	
-Methylnaphthalene ⁽³⁾	Chronic	4.0E-03	mg/kg/day	1	4.0E-03	mg/kg/day	Lungs	1000/1	IRS	4/24/2008
2-Methylnaphthalene	Chronic	4.0E-03	mg/kg/day	1	4.0E-03	mg/kg/day	Lungs	1000/1	IRS	4/24/2008
Benzo(a)anthracene	NA NA	NA NA	NA NA	NA	NA	NA	NA	NA NA	NA	NA NA
3enzo(a)pyrene	NA	NA .	NA NA	NA	NA	NA	NA	NA I	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA.	NA .	NA	NA	NA NA	NA	NA
Benzo(k)fluoranthene	NA NA	NA	NA	NA NA	NA	NA	NA .	NA I	NA	NA NA
Dibenzo(a,h)anthracene	NA NA	NA	NA.	NA	NA .	NA	· NA	NA I	NA	NA NA
lexachlorobenzene	Chronic	8.0E-04	mg/kg/day	1	8.0E-04	mg/kg/day	Liver	100/1		
ndeno(1,2,3-cd)pyrene	NA NA	NA	NA .	NA	NA	NA	NA	NA I	NA	NA
Naphthalene	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Body Weight	3000/1	IRS	4/24/2008
norganics							·			
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	PPRTV	10/23/2006
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRS	4/24/2008
ron	Chronic	7.0E-01	mg/kg/day	1 1	7.0E-01	mg/kg/day	GS	1.5	PPRTV	9/11/2006
/langanese	Chronic	2.4E-02	mg/kg/day	0.04	9.6E-04	mg/kg/day	CN\$	1/3	IRS	4/24/2008
/anadium	Chronic	1.0E-03	mg/kg/day	0.026	2.6E-05	mg/kg/day	Kidney	300	USEPA III	10/11/2007

Notes:

- 1 U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
- 2 Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.
- 3 -Value is for 2-methylnaphthalene.

Definitions:

CNS = Central Nervous System

CVS = Cardiovascular system

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

GS = Gastrointestinal system

IRIS = Integrated Risk Information System

NA = Not Applicable

TABLE 5.2 NON-CANCER TOXICITY DATA -- INHALATION SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Chronic/ Subchronic	Inhalat	tion RfC	Extrapol	ated RfD ⁽¹⁾	Primary Target	Combined Uncertainty/Modifying	RfC : Targ	get Organ(s)
Concern		Value	Units	Value	Units	Organ(s)	Factors	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds									
Bromodichloromethane	NA	NA	. NA	NA	NA NA	NA	NA NA	NA	NA
Chloroform	NA	NA	NA	NA NA	NA	NA	NA NA	NA	NA
Tetrachloroethene	Chronic	2.8E-01	mg/m ³	8.0E-02	(mg/kg/day)	Liver	NA NA	USEPA III	10/11/2007
Trichloroethene	Chronic	3.5E-02	mg/m3	1.0E-02	(mg/kg/day)	Liver, CNS	NA.	USEPA(1)	8/2001
Semivolatile Organic Compounds									
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA NA	NA	NA NA
2-Methylnaphthalene	NA	NA	NA	NA	NA NA	NA	NA NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA NA	NA	NA
Benzo(a)pyrene	NA .	NA ·	NA	NA	NA	NA	NA NA	NA ·	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA ·	NA	. NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA.	. NA	NA NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	. NA	NA	NA	NA	NA NA	NA	NA NA
Naphthalene	Chronic	3.0E-03	mg/m³	8.6E-04	(mg/kg/day)	Nasal	3000/1	IRIS	4/24/2008
Inorganics									
Aluminum	Chronic	0.005	mg/m3	1.4E-03	(mg/kg/day)	CNS	300	PPRTV	10/23/2006
Arsenic	NA	NA	NA	NA	NA	NA	NA NA	NA	NA
Iron	NA	NA	NA	NA .	NA	NA	NA	NA .	NA
Manganese	Chronic	5.0E-05	mg/m³	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	4/24/2008
Vanadium	NA	. NA	NA	NA	NA	NA	NA	. NA	NA

Notes:

1 - Extrapolated RfD = RfC *20m3/day / 70 kg

Definitions:

CNS = Central Nervous System

EPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

HEAST= Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information System

NA = Not Applicable

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

TABLE 6.1 CANCER TOXICITY DATA -- ORAL/DERMAL SITE 23 - UNDERDRAIN METERING PIT SAMPLING

NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential		er Slope Factor	Oral Absorption Efficiency		ncer Slope Factor Permal ⁽²⁾	Weight of Evidence/ Cancer Guideline	Ora	al CSF
Concern	Value	Units	for Dermal ⁽¹⁾	Value	Units	Description	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compound	S							(WINN/DD/TTTT)
Bromodichloromethane	6.2E-02	(mg/kg/day)-1	1 1	6.2E-02	(mg/kg/day)-1	B2 T	IRIS	4/04/0000
Chloroform	NA NA	NA	NA NA	NA	NA NA	B2	IRIS	4/24/2008
Tetrachloroethene	5.4E-01	(mg/kg/day)-1	1	5.4E-01	(mg/kg/day)-1	NA NA	IRIS	4/24/2008
Trichloroethene	4.0E-01	(mg/kg/day)-1	1	4.0E-01	(mg/kg/day)-1	t c	USEPA(1)	4/24/2008
Semivolatile Organic Comp	ounds		<u> </u>		1 (mg/ng/day)-1		USEPA(I)	8/2001
1-Methylnaphthalene	NA NA	NA	NA I	NA	l NA	l NA T	NA NA	T NA
2-Methylnaphthalene	NA.	NA	NA NA	NA	NA NA	NA NA	NA NA	NA NA
Benzo(a)anthracene	7.3E-01	(mg/kg/day)-1	1	7.3E-01	(mg/kg/day)-1	B2	USEPA(2)	
Benzo(a)pyrene	7.3E+00	(mg/kg/day)-1	1	7.3E+00	(mg/kg/day)-1	B2	IRIS	7/1993
Benzo(b)fluoranthene	7.3E-01	(mg/kg/day)-1	1	7.3E-01	(mg/kg/day)-1	B2	USEPA(2)	7/20/2007
Benzo(k)fluoranthene	7.3E-02	(mg/kg/day)-1	1	7.3E-02	(mg/kg/day)-1	B2	USEPA(2)	7/1993
Dibenzo(a,h)anthracene	7.3E+00	(mg/kg/day)-1	1	7.3E+00	(mg/kg/day)-1	B2		7/1993
Hexachlorobenzene	1.6E+00	(mg/kg/day)-1	1	1.6E+00	(mg/kg/day)-1	B2	USEPA(2)	7/1993
ndeno(1,2,3-cd)pyrene	7.3E-01	(mg/kg/day)-1	1	7.3E-01	(mg/kg/day)-1	B2		4/24/2008
Naphthalene	NA	NA NA	NA NA	NA	NA NA	C	USEPA(2) IRIS	7/1993
norganics				777	1 190	<u> </u>	IRIS	4/24/2008
Aluminum	NA	NA NA	NA I	NA	l NA	NA I	NA	1 11
Arsenic	1.5E+00	(mg/kg/day) ⁻¹	1	1,5E+00	(mg/kg/day)	A		NA A/OA/ROOS
ron	NA	NA NA	NA NA	NA NA	NA NA	NA NA	IRIS	4/24/2008
/anganese	NA	NA	NA	NA NA	NA NA	D	NA IDIO	NA NA
/anadium	NA	NA	NA NA	NA .	NA NA	NA NA	IRIS NA	4/24/2008 NA

Notes:

- 1 U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
- 2 Adjusted cancer slope factor for dermal =

Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

IRIS = Integrated Risk Information System.

NA = Not Available.

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

USEPA(2) = U.S. EPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.

EPA Group:

- A Human carcinogen.
- B1 Probable human carcinogen indicates that limited human data are available.
- B2 Probable human carcinogen indicates sufficient evidence in animals and inadequate or no evidence in humans .
- C Possible human carcinogen.
- D Not classifiable as a human carcinogen.
- E Evidence of noncarcinogenicity.

TABLE 6.2 CANCER TOXICITY DATA -- INHALATION SITE 23 - UNDERDRAIN METERING PIT SAMPLING NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Uni	t Risk		on Cancer Factor ⁽¹⁾	Weight of Evidence/ Cancer Guideline	Unit Risk : I	nhalation CSF
Concern	Value	Units	Value	Units	Description	Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds	s						
Bromodichloromethane	NA NA	NA NA	NA	NA	B2	IRIS	4/24/2008
Chloroform	2.3E-05	(ug/m ³) ⁻¹	8.1E-02	(mg/kg/day) ⁻¹	B2	IRIS	4/24/2008
Tetrachloroethene	5.7E-06	(ug/m ³) ⁻¹	2.0E-02	(mg/kg/day) ⁻¹	NA	USEPA III	10/11/2007
Trichloroethene	1.1E-04	(ug/m3)-1	4.0E-01	(mg/kg/day)-1	С	USEPA(1)	8/2001
Semivolatile Organic Compo	ounds						
1-Methylnaphthalene	NA	NA .	NA	NA	NA	NA	4/24/2008
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	4/24/2008
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	8.9E-04	(ug/m ³) 1	3.1E+00	(mg/kg/day) ⁻¹	NA	USEPA III	10/11/2007
Benzo(b)fluoranthene	NA	NA	NA	NA	NA NA	NA .	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	4.6E-04	(ug/m ³) ⁻¹	1.6E+00	(mg/kg/day) ⁻¹	B2	IRIS	4/24/2008
Indeno(1,2,3-cd)pyrene	NA	NA NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	С	IRIS	4/24/2008
Inorganics							
Aluminum	NA .	NA	NA	NA	NA NA	NA	NA
Arsenic	4.3E-03	(ug/m ³) ⁻¹	1.5E+01	(mg/kg/day) ⁻¹	Α	iris .	4/24/2008
Iron	NA	NA	NA	NA	NA	NA	NA
Manganese	NA NA	NA	NA	NA	D	IRIS	4/24/2008
Vanadium	NA	NA	NA	NA	NA NA	NA;	NA

Notes:

1 - Inhalation CSF = Unit Risk * 70 kg / 20m³/day.

Definitions:

IRIS = Integrated Risk Information System.

NA = Not Available.

USEPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

EPA Group:

- A Human carcinogen.
- B1 Probable human carcinogen indicates that limited human data are available.
- B2 Probable human carcinogen indicates sufficient evidence in animals and inadequate or no evidence in humans .
- C Possible human carcinogen.
- D Not classifiable as a human carcinogen.
- E Evidence of noncarcinogenicity.

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 1

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	E	PC		Car	cer Risk Calcula	ations			Non-Ca	ncer Hazard C	alculations	
				Potential Concern	Value	Units	Intake/Exposur	re Concentration		Jnit Risk	Cancer Risk	intake/Exposur	re Concentration		D/RfC	Hazard Quotier
					1		Value	Units	Value	Units		Value	Units	Value	Units	1
iroundwater	Groundwater	Site 23	Dermal	Bromodichloromethane	0.300	ug/L	4.4E-10	(mg/kg/day)	6.2E-02	(mg/kg/day) 1	2.7E-11	3.1E-08	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.000002
				Chloroform	2.500	ug/L	4.6E-09	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		3.2E-07	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.00003
				Tetrachloroethene	0.400	ug/L	4.1E-09	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	2.2E-09	2.9E-07	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.00003
		,		Trichloroethene	0.500	ug/L	1.6E-09	(mg/kg/day)	4.0E-01	(mg/kg/day) ⁻¹	6.5E-10	1.1E-07	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.0004
				1-Methylnaphthalene	0.492	ug/L	1.1E-08	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		8.0E-07	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.0002
				2-Methylnaphthalene	0.600	ug/L	1.4E-08	(mg/kg/day)	NA ·	(mg/kg/day) ⁻¹		9.7E-07	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.0002
			1	Benzo(a)anthracene	1.	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(a)pyrene	0.2	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day)*1	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Benzo(b)fluoranthene	0.3	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Benzo(k)fluoranthene	0.32	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
		,		Dibenzo(a,h)anthracene	0.12	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0.05+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Hexachlorobenzene	0.65	ug/L	4.9E-08	(mg/kg/day)	1.6E+00	(mg/kg/day) ⁻¹	7.9E-08	3.4E-06	(mg/kg/day)	8.0E+04	(mg/kg/day)	0.004
				Indeno(1,2,3-cd)pyrene	0	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)*1	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	ļ
				Naphthalene	1	ug/L	6.6E-09	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	**	4.6E-07	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.00002
			Ì	Aluminum	322.00	ug/L	7.1E-08	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		5.0E-06	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.000005
				Arsenic	13.90	ug/L	3.1E-09	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	4.6E-09	2.2E-07	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.0007
		+*		Iron	70800.00	ug/L	1.6E-05	(mg/kg/day)	NA	(mg/kg/day)*1	·· .	1.1E-03	(mg/kg/day)	7.0E-01	(mg/kg/day)	0.002
			· .	Manganese	845.0	ug/L	. 1.9E-07	(mg/kg/day)	NA	(mg/kg/day)*1	••	1.3E-05	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.01
				Vanadium	3.7	ug/L	8.2E-10	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹	••	5.7E-08	(mg/kg/day)	2.6E-05	(mg/kg/day)	0.002
			Exp. Route Total								8.6E-08					0.02
		Exposure Point Total						`			8.6E-08					0.02
	Exposure Medium Total										8.6E-08					. 0.02
	Air ·	Site 23	Inhalation	Bromodichloromethane	8.4E-6	mg/m3	1.4E-09	(mg/kg/day)	NA	(mg/kg/day) 1	••	9.9E-08	(mg/kg/day)	NA	(mg/kg/day)	-
				Chloroform	8.4E-5	mg/m3	1.46-08	(mg/kg/day)	8.1E-02	(mg/kg/day) ¹	1.1E-09	9.8E-07	(mg/kg/day)	1.4E-02	(mg/kg/day)	0.00007
				Tetrachiomethene	1.1E-5	mg/m3	1.9E-09	(mg/kg/day)	2.0E-02	(mg/kg/day) ⁻¹	3.9E-11	1.3E-07	(mg/kg/day)	8.0E-02	(mg/kg/day)	0.000002
				Trichloroethene	1.6E-5	mg/m3	2.7E-09	(mg/kg/day)	4.0E-01	(mg/kg/day)	1.1E-09	1.9E-07	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.00002
			1	1-Methylnaphthalene	1.4E-5	mg/m3	2.4E-09	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	• •	1.7E-07	(mg/kg/day)	NA	(mg/kg/day)	-
				2-Methylnaphthalene	9.5E-6	mg/m3	1.6E-09	(mg/kg/day)	NA	(mg/kg/day) ¹		1.1E-07	(mg/kg/day)	NA .	(mg/kg/day)	
			-	Benzo(a)anthracene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
			·	Benzo(a)pyrene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	3.1E+00	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	'NA	(mg/kg/day)	-
				Benzo(b)fluoranthene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(k)fluoranthens	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Dibenzo(a,h)anthracene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) 1		0.0€+00	(mg/kg/day)	, NA	(mg/kg/day)	
				Hexachlorobenzene	0.0E+0	mg/m3	0,0E+00	(mg/kg/day)	1.6E+00	(mg/kg/day) '	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
		•	.	Indeno(1,2,3-cd)pyrene	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	· NA	(mg/kg/day)	••	0.0E+00	(mg/kg/day)	NA .	(mg/kg/day)	
	į l			Naphthalene	1.6E-5	mg/m3	2.7E-09	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹	••	1.9E-07	(mg/kg/day)	9.0E-04	(mg/kg/day)	0.0002
				Atuminum	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)		0.0E+00	(mg/kg/day)	1.4E-03	(mg/kg/day)	
				Arsenic	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	1.5E+01	(mg/kg/day) 1	••	0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	-
				Iron	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Manganese	0.0E+0	mg/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	••	0.0E+00	(mg/kg/day)	1.4E-05	(mg/kg/day)	-
				Vanadium	0.0E+0	rng/m3	0.0E+00	(mg/kg/day)	NA	(mg/kg/day) 1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			Exp. Route Total	L							2.3E-09		· · · · · · ·			0.0003
		Exposure Point Total		 							2.3E-09					0.0003
	Exposure Medium Total						¥ .				2.3E-09	ı				0.0003
	Exposore mediani rotar			* * * * * * * * * * * * * * * * * * * *												·
Medium Total	Exposure mediani rotal			· · · · · · · · · · · · · · · · · · ·						Across All Media	8.8E-08 8.8E-08			Across All Media	0.02	

TABLE 7.2.RME CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	E	PC	1	Car	cer Risk Calcula	tions	***************************************		Non Co	ncer Hazard C	alculations	
				Potential Concern	Value	Units	Intake/Exposu	re Concentration		Jnit Risk	Cancer Risk	Intake/Exposu	re Concentration		D/RfC	Hazard Quotient
							Value	Units	Value	Units	Cancernak	Value	Units	Value	Units	Hazard Guotient
Groundwater	Groundwater	Site 23	Ingestion	Bromodichloromethane	0.300	ug/L	2.5E-06	(mg/kg/day)	6.2E-02	(mg/kg/day)*1	1.5E-07	2.9E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.001
			1	Chloroform	2.500	ug/L	2.1E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		2.4E-04	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.02
			'	Tetrachloroethene	0.400	ug/L	3.3E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.8E-06	3.8E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.004
				Trichloroethene	0.500	ug/L	4.1E-06	(mg/kg/day)	4.0E-01	(mg/kg/day)*1	1.6E-06	4.8E-05	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.2
	ļ			1-Methylnaphthalene	0.492	ug/L	4.0E-06	(mg/kg/day)	. NA	(mg/kg/day) 1		4.7E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.01
	[2-Methylnaphthalene	0.600	ug/L	4.9E-06	(mg/kg/day)	NA NA	(mg/kg/day) ¹		5.8E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.01
•				Benzo(a)anthracene	0.510	ug/L	2.2E-05	(mg/kg/day)	7.3E-01	(mg/kg/day)*1	1.6E-05	4.9E-05	(mg/kg/day)	NA.	(mg/kg/day)	
				Benzo(a)pyrene	0.225	ug/L	9.9E-06	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹	7.2E-05	2.2E-05	(mg/kg/day)	NA.	(mg/kg/day)	
		*		Benzo(b)fluoranthene	0.340	ug/L	1.5E-05	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	1.1E-05	3.3E-05	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(k)fluoranthene	0.315	ug/L	1.4E-05	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹	1.0E-06	3.0E-05	(mg/kg/day)	NA.	(mg/kg/day)	
				Dibenzo(a,h)anthracene	0.120	ug/L	5.3E-06	(mg/kg/day)	7.3E+00	(mg/kg/day)*1	3.8E-05	1.2E-05	(mg/kg/day)	NA	(mg/kg/day)	
	1			Hexachlorobenzene	0.650	ug/L	5.3E-06	(mg/kg/day)	1.6E+00	(mg/kg/day)*1	8.5E-06	6.2E-05	(mg/kg/day)	8.0E-04	(mg/kg/day)	0.08
				Indeno(1,2,3-cd)pyrene	0.160	ug/L	7.0E-06	(mg/kg/day)	7.3E-01	(mg/kg/day)*1	5.1E-06	1.5E-05	(mg/kg/day)	NA	(mg/kg/day)	-
1				Naphthalene	0.552	ug/L	4.5E-06	(mg/kg/day)	· NA	(mg/kg/day) ⁻¹		5.3E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.003
				Aluminum	322	ug/L	2.6E-03	(mg/kg/day)	NA	(mg/kg/day)*1		3.1E-02	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.03
			1	Arsenic	13.90	ug/L	1.1E-04	(mg/kg/day)	1.5E+00	(mg/kg/day)*3	1.7E-04	1.3E-03	(mg/kg/day)	3.0E-04	(mg/kg/day)	4.4
i ·				Iron	70800	ug/L	5.8E-01	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		6.8E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	9.7
				Manganese	845	ug/L	6.9E-03	(mg/kg/day)	ŇA	(mg/kg/day) ⁻¹		8.1E-02	(mg/kg/day)	2.4E-02	(mg/kg/day)	3.4
ĺ				Vanadium	3.70	ug/L	3.0E-05	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		3.5E-04	(mg/kg/day)	1.0E-03	(mg/kg/day)	0.4
			Exp. Route Total			•		, , , , ,	· · · · · · · · · · · · · · · · · · ·		3.3E-04					18
			Dermal .	Bromodichloromethane	0.300	ug/L	2.2E-08	(mg/kg/day)	6.2E-02	(mg/kg/day) ⁻¹	1.3E-09	7.6E-07	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.00004
			1	Chloroform	2.500	ug/L	2.0E-07	(mg/kg/day)	NA	(mg/kg/day)"		7.0E-06	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.0007
			i	Tetrachioroethene	0.400	ug/L	2.1E-07	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.1E-07	7.4E-06	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.0007
				Trichloroethene	0.500	ug/L	7.4E-08	(mg/kg/day)	4.0E-01	(mg/kg/day) ⁻¹	3.0E-08	2.6E-06	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.009
}				1-Methylnaphthalene	0.492	ug/L	6.0E-07	(mg/kg/day)	NA ·	(mg/kg/day) ⁻¹		2.1E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.005
	1			2-Methylnaphthalene	0.600	ug/L	7.2E-07	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		2.5E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.006
			1	Benzo(a)anthracene	0.510	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)"		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(a)pyrene	0.225	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0,0€+00	(mg/kg/day)	· NA	(mg/kg/day)	
	+			Benzo(b)fluoranthene	0.340	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	. NA	(mg/kg/day)	-
				Benzo(k)fluoranthene	0.315	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day)*1		0.0€+00	(mg/kg/day)	NA	(mg/kg/day)	
				Dibenzo(a,h)anthracene	0.120	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day)*1		0.0€+00	(mg/kg/day)	NA.	(mg/kg/day)	
				Hexachlorobenzene	0.650	ug/L	2.7E-06	(mg/kg/day)	1.6E+00	(mg/kg/day)*1	4.3E-06	9.4E-05	(mg/kg/day)	8.0E-04	(mg/kg/day)	0.1
			:	Indeno(1,2,3-cd)pyrene	0.160	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
:				Naphthalene	0.552	ug/L	3.2E-07	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		1.1E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.0006
				Aluminum	322	ug/L	9.7E-07	(mg/kg/day)	NA	(mg/kg/day)"		3.4E-05	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.00003
				Arsenic	13.90	ug/L	4.2É-08	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	6.3E-08	1.5E-06	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.005
	· .			Iron	70800	ug/L	2.1E-04	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		7.5E-03	(mg/kg/day)	7.0E-01	(mg/kg/day)	0.01
			' .	Manganese	845	ug/L	2.5E-06	(mg/kg/day)	NA	(mg/kg/day) 1		8.9E-05	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.09
				Vanadium	3.70	ug/L	1.1E-08	(mg/kg/day)	NA	(mg/kg/day) ⁻¹		3.9E-07	(mg/kg/day)	2.6E-05	(mg/kg/day)	0.02
*			Exp. Route Total								4.5E-06					0.3
		Exposure Point Total									3.3E-04					18
	Exposure Medium Total										3.3E-04					18

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT

NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium Exposure Medium Exposure Point Exposure Route Chemical of EPC Cancer Risk Calculations Non-Cancer Hazard Calculations Potential Concern Intake/Exposure Concentration CSF/Unit Risk Intake/Exposure Concentration Cancer Risk RfD/RfC Hazard Quotier Value Units Value Units Value Units Value Units Site 23 Inhalation 0.300 2.5E-06 Bromodichloromethane 6.2E-02 (mg/kg/day) (mg/kg/day) 1.5E-07 2.9E-05 (mg/kg/day) 2.0E-02 (mg/kg/day) 0.001 Chloroform 2 500 ug/L 2.1E-05 (mg/kg/day) NA (mg/kg/day)⁻¹ 2.4E-04 (mg/kg/day) 1.0E-02 (mg/kg/day) 0.02 0.400 Tetrachioroethene ug/L 3.3E-06 (mg/kg/day) 5.4E-01 (mg/kg/day)⁻¹ 1.8E-06 3.8E-05 (mg/kg/day) 1.0E-02 (mg/kg/day) 0.004 Trichlomethene 0.500 ug/L 4.1E-06 (mg/kg/day) 4.0E+01 (mg/kg/day)⁻¹ 1.6E-06 4.8E-05 (mg/kg/day) 3.0E-04 (mg/kg/day) 0.2 1-Methylnaphthalene 0.492 ug/L 4.0E-06 (mg/kg/day) NA (mg/kg/day)⁻¹ 4.7E-05 (mg/kg/day) 4.0E-03 .. (mg/kg/day) 0.01 2-Methylnaphthalene 0.600 ug/L 4.9E-06 (mg/kg/day) NA (mg/kg/day)⁻¹ 5.8E-05 (mg/kg/day) . . 4.0E-03 0.01 (mg/kg/day) Benzo(a)anthracene 0.0E+00 (mg/kg/day) ug/L 7.3E-01 0.0E+00 (mg/kg/day)*1 .. (mg/kg/day) (mg/kg/day) Benzo(a)pyrene 0.225 ug/L 0.0E+00 (mg/kg/day) 7.3E+00 .. (mg/kg/day) 1 .0.0E+00 (mg/kg/day) (mg/kg/day) Benzo(b)fluoranthene 0.340 0.0E+00 ug/L 7.3E-01 (mg/kg/day) (mg/kg/day)¹ --0.0E+00 (mg/kg/day) (mg/kg/day) 0.315 0.0E+00 Benzo(k)fluoranthene ug/L (mg/kg/day) 7.3E-02 (mg/kg/day)¹ 0.0E+00 (mg/kg/day) (mg/kg/day) Dibenzo(a.h)anthracene 0.120 ug/L 0.0E+00 (mg/kg/day) 7.3E+00 (mg/kg/day)⁻¹ --0.0E+00 (mg/kg/day) NA (mg/kg/day) Hexachlombenzene 0.650 ug/L 0.0E+00 (mg/kg/day) 1.6E+00 (mg/kg/day)¹ 0.0E+00 (mg/kg/day) 8.0E-04 (mg/kg/day) Indeno(1,2,3-cd)pyrene 0.160 ug/L 0.0E+00 (mg/kg/day) 7.3E-01 (mg/kg/day)⁻¹ 0.0E+00 (mg/kg/day) NA (mg/kg/day) Nachthalene 0.552 ug/L. 4.5E-06 (mg/kg/day) --5.3E-05 (mg/kg/day) 2.0E-02 0.003 (mg/kg/day)* (mg/kg/day) 322 ug/L 0.0E+00 (mg/kg/day) NA - -1.05+00 (mg/kg/day) 0.0E+00 (mg/kg/day) (mg/kg/day) Arsenic 13.90 ug/L 0.0E+00 (mg/kg/day) 1.5F+00 (mg/kg/day)¹ .. 0.05+00 (mg/kg/day) 3.0E-04 (mg/kg/day) 70800 ug/L 0.06+00 (mg/kg/day) NA (mg/kg/day)⁻¹ .. 0.0E+00 (mg/kg/day) 7.0E-01 (mg/kg/day) Manganese 845 ug/L 0.0E+00 (mg/kg/day) NA (mg/kg/day)⁻¹ 0.0E+00 (mg/kg/day) 2.4E-02 (mg/kg/day) Vanadium 3.70 0.05+00 ug/L (mg/kg/day) NA (mg/kg/day)⁻¹ (mg/kg/day) 1.0E-03 (mg/kg/day) Exp. Route Total 3.6E-06 0.2 Exposure Point Total 3.6E-06 0.2 Exposure Medium Total 3.6E-06 0.2 Medium Total 3.4E-04 19 Total of Receptor Risks Across All Media 3.4E-04 Total of Receptor Hazards Across All Media

Note:

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of	E	PC	1	Can	ncer Risk Calcula	ations			Non-Ca	ncer Hazard C	alculations	
indui				Potential Concern	Value	Units	Intake/Exposu	re Concentration		Unit Risk	Cancer Risk	Intake/Exposu	re Concentration		D/RfC	Hazard Quotient
				1			Value	Units	Value	Units		Value	Units	Value	Units	1
Groundwater	Groundwater	Site 23	Ingestion	Bromodichloromethane	0.300	ug/L	2.3E-06	(mg/kg/day)	6.2E-02	(mg/kg/day) ⁻¹	1.5E-07	2.0E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.0010
				Chloroform	2.500	ug/L	2.0€-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.6E-04	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.02
				Tetrachloroethene	0.400	ug/L	3.1E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.7E-06	2.6E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.003
			1	Trichloroethene	0.500	ug/L	3.9E-06	(mg/kg/day)	4.0E-01	(mg/kg/day) ⁻¹	1.6E-06	3.3E-05	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.1
	•			1-Methylnaphthalene	0.492	ug/L	3.9E-06	(mg/kg/day)	NA.	(mg/kg/day)		3.2E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.008
				2-Methylnaphthalene	0.600	ug/L	4.7E-06	(mg/kg/day)	NA NA	(mg/kg/day) 1		3.9E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.010
				Benzo(a)anthracene	0.510	ug/L	8.0E-06	(mg/kg/day)	7.3E-01	(mg/kg/day)"	5.8E-06	3.4E-05	(mg/kg/day)	NA	(mg/kg/day)	
	1			Benzo(a)pyrene	0.225	ug/L	3.5E-06	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹	2.6E-05	1.5E-05	(mg/kg/day)	NA:	(mg/kg/day)	
		i		Benzo(b)fluoranthene	0.340	ug/L	5.3E-06	(mg/kg/day)	7.3E-01	(mg/kg/day)	3.9E-06	2.2E-05	(mg/kg/day)	NA.	(mg/kg/day)	-
				Benzo(k)fluoranthene	0.315	ug/L	4.9E-06	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹	3.6E-07	2.1E-05	(mg/kg/day)	NA	(mg/kg/day)	
			1.	Dibenzo(a,h)anthracene	0.120	.ug/L	1.9E-06	(mg/kg/day)	7.3E+00	(mg/kg/day)"	1.4E-05	7.9E-06	(mg/kg/day)	NA · .	(mg/kg/day)	-
				Hexachiorobenzene	0.650	ug/L	5.1E-06	(mg/kg/day)	1.6E+00	(mg/kg/day) ⁻¹	8.16-06	4.3E-05	(mg/kg/day)	8.0E-04	(mg/kg/day)	0.05
				Indeno(1,2,3-cd)pyrene	0.160	ug/L	2.5E-06	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹	1.8E-06	1.1E-05	(mg/kg/day)	NA.	(mg/kg/day)	-
·	. '			Naphthalene	0,552	ug/L	4.3E-06	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		3.6E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.002
				Aluminum	322	ug/L	2.5E-03	(mg/kg/day)	NA NA	(mg/kg/day)*1	·	2.1E-02	(mg/kg/day)	1,0E+00	(mg/kg/day)	0.02
			1	Arsenic	13.90	ug/L	1.1E-04	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	1.6E-04	9.1E-04	(mg/kg/day)	3.0E+04	(mg/kg/day)	3.0
				Iron	70800	ug/L	5.5E-01	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		4.7E+00	(mg/kg/day)	7.0E+01	(mg/kg/day)	6.7
				Manganese	845	ug/L	6.6E-03	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	••	5.6E-02	(mg/kg/day)	2.4E-02	(mg/kg/day)	2.3
				Vanadium -	3.70	ug/L	2.9E-05	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		2.4E-04	(mg/kg/day)	1.0E-03	(mg/kg/day)	0.2
			Exp. Route Total								2.3E-04					12
			Dermal	Bromodichloromethane	0.300	ug/L	1.5E-07	(mg/kg/day)	6.2E-02	(mg/kg/day) ⁻¹	9.4E-09	1.1E-06	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.00005
		-		Chloroform	2.500	ug/L	1.4E+06	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		9.8E-06	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.0010
				Tetrachioroethene	0.400	ug/L	1.5E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	8.0E-07	1.0E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.001
		·		Trichloroethene	0.500	ug/L	5.2E-07	(mg/kg/day)	4.0E-01	(mg/kg/day) ⁻¹	2.1E-07	3.6E-06	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.01
	· ·			1-Methylnaphthalene	0.492	ug/L	4.2E-06	(mg/kg/day)	NA.	(mg/kg/day)*1		3.0€-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.007
				2-Methylnaphthalene	0.600	ug/L	5.1E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		3.6E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.009
				Benzo(a)anthracene	0.510	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	**
				Benzo(a)pyrene	0.225	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Benzo(b)fluoranthene	0.340	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
				Benzo(k)fluoranthene	0.315	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
				Dibenzo(a,h)anthracene	0.120	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			-	Hexachlorobenzene	0.650	ug/L	1.9E-05	(mg/kg/day)	1.6E+00	(mg/kg/day) ⁻¹	3.0E-05	1.3E-04	(mg/kg/day)	8.0E-04	(mg/kg/day)	0.2
	1		1	Indeno(1,2,3-cd)pyrene	0.160	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
				Naphthalene	0.552	ug/L	2.2E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.6E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.0008
				Aluminum	322	ug/L	6.8E-06	(mg/kg/day)	NA NA	(mg/kg/day) 1		4.8E-05	(mg/kg/day)	1.0E+00	(mg/kg/day)	0.00005
				Arsenic	13.90	ug/L	2.9E-07	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹	4.4E-07	2.1E-06	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.007
	1			iron	70800	ug/L	1.5E-03	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹	•••	1.0E-02	(mg/kg/day)	7.0E-01	(mg/kg/day)	0.01
				Manganese	845	ug/L	1.8E-05	(mg/kg/day)	NA .	(mg/kg/day) ⁻¹		1.3E-04	(mg/kg/day)	9.6E-04	(mg/kg/day)	0.1
		, ·		Vanadium	3.70	ug/L	7.8E-08	(mg/kg/day)	NA	(mg/kg/day) ⁻¹	••	5.5€-07	(mg/kg/day)	2.6E-05	(mg/kg/day)	0.02
			Exp. Route Total								3.1E-05					0.4
		Exposure Point Total									2.6E-04					13
	Exposure Medium Total										2.6E-04					13

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT

NSB-NLON, GROTON, CONNECTICUT

PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of		PC		Car	ncer Risk Calcula	ations			Non-Ca	ncer Hazard C	alculations	
				Potential Concern	Value	Units	Intake/Exposu	re Concentration	CSF/	Unit Risk	Cancer Risk	Intake/Exposu	re Concentration	Rf	D/RfC	Hazard Quotie
						<u> </u>	Value	Units	Value	Units		Value	Units	Value	Units	1
roundwater	Air	Site 23	Inhalation	Bromodichloromethane	0.300	ug/L	2.3E-06	(mg/kg/day)	6.2E-02	(mg/kg/day) ⁻¹	1.5E-07	2.0E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.0010
				Chloroform	2.500	ug/L	2.0E-05	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		1.6E-04	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.02
		,	1	Tetrachloroethene	0.400	ug/L	3.1E-06	(mg/kg/day)	5.4E-01	(mg/kg/day) ⁻¹	1.7E-06	2.6E-05	(mg/kg/day)	1.0E-02	(mg/kg/day)	0.003
		1		Trichloroethene	0.500	ug/L	3.9E-06	(mg/kg/day)	4.0E-01	(mg/kg/day)"	1.6E-06	3.3€-05	(mg/kg/day)	3.0E-04	(mg/kg/day)	0.1
				1-Methylnaphthalene	0.492	ug/L	3.9E-06	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		3.2E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.008
				2-Methylnaphthalene	0.600	ug/L	4.7E-06	(mg/kg/day)	NA.	(mg/kg/day) ⁻¹		3.9E-05	(mg/kg/day)	4.0E-03	(mg/kg/day)	0.010
				Benzo(a)anthracene	0.510	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
		1	1	Benzo(a)pyrene	0.225	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day)"		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Benzo(b)fluoranthene	0.340	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1	Benzo(k)fluoranthene	0.315	ug/L	0.0E+00	(mg/kg/day)	7.3E-02	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
		1		Dibenzo(a,h)anthracene	0.120	ug/L	0.0E+00	(mg/kg/day)	7.3E+00	(mg/kg/day)'		0.0E+00	(mg/kg/day)	NA	(mg/kg/day)	
			1.	Hexachlorobenzene	0.650	ug/L	0.0E+00	(mg/kg/day)	1.6E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	8.0E-04	(mg/kg/day)	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				Indeno(1,2,3-cd)pyrene	0.160	ug/L	0.0E+00	(mg/kg/day)	7.3E-01	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)	
		Ì		Naphthalene	0.552	ug/L	4.3E-06	(mg/kg/day)	NA .	(mg/kg/day)"		3.6E-05	(mg/kg/day)	2.0E-02	(mg/kg/day)	0.002
			Į.	Aluminum	322	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day) ¹		0.0E+00	(mg/kg/day)	1.0E+00	(mg/kg/day)	
				Arsenic	13.90	ug/L	0.0E+00	(mg/kg/day)	1.5E+00	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	3.0E-04	(mg/kg/day)	1 [
			1 .	Iron	70800	ug/L	0.0E+00	(mg/kg/day)	NA.	(mg/kg/day)*1		0.0E+00	(mg/kg/day)	7.0E-01	(mg/kg/day)	
				Manganese	845	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	2.4E-02	(mg/kg/day)	
				Vanadium	3.70	ug/L	0.0E+00	(mg/kg/day)	NA NA	(mg/kg/day) ⁻¹		0.0E+00	(mg/kg/day)	1.0E-03	(mg/kg/day) (mg/kg/day)	
			Exp. Route Total	***************************************	1 5.70	1. dg/L	0.02.100	(Highey/GBY)	140	(mg/kg/day)	3.4E-06	0.02+00	(mg/kg/day)	1.06+03	(mg/kg/day)	0.1
		Exposure Point Total	Comp			·					3.4E-06		***************************************			0.1
	Exposure Medium Total	I STATE OF THE PARTY OF THE PAR							****		3.4E-06					
Medium Total	1 - 7000										3.4E-06 2.6E-04		-			0.1
					· · · · · · · · · · · · · · · · · · ·				Receptor Risks		2.6E-04				Across All Media	13

Note: Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 2

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk			Non-Carcino	genic Hazard Q	uotient	
			Concern	Ingestion	Inhalation	Dermal	External	Exposure	Primary	ingestion	Inhalation	Dermal	Exposure
							(Radiation)	Routes Total	Target Organ(s)]			Routes Total
Groundwater	Groundwater	Site 23	Bromodichloromethane		•	3E-11	-	3E-11	Kidney	-		0.000002	0.000002
		·	Chloroform		-	••	-	••	Liver	-	••	0.00003	0.00003
	' <u> </u>		Tetrachloroethene			2E-09	- 1	2E-09	Liver	-	••	0.00003	0.00003
			Trichloroethene		-	6E-10		6E-10	Liver, Kidney	-		0.0004	0.0004
			1-Methylnaphthalene				-		Lungs	-		0.0002	0.0002
			2-Methylnaphthalene		-		-		Lungs	-		0.0002	0.0002
			Benzo(a)anthracene		-		-		NA NA			-	
			Benzo(a)pyrene				_		NA.	_		-	
			Benzo(b)fluoranthene		-		-		NA NA	-		-	
			Benzo(k)fluoranthene				1 - 1		NA NA	-		-	
			Dibenzo(a,h)anthracene		_		_		NA NA	-		_	
			Hexachlorobenzene			8E-08		8 € -08	Liver	-		0.004	0.004
			indeno(1,2,3-cd)pyrene						NA ·	-		_	
			Naphthalene	ļ <u>.</u> .			\ <u></u>		Body Weight	-		0.00002	0.00002
			Aluminum	l			_		CNS			0:000005	0.000005
			Arsenic			5E-09		5E-09	Skin, CVS			0.0007	0.0007
			Iron	l					GS			0.002	0.002
			Manganese	l	_				CNS	_		0.01	0.01
			Vanadium						Kidney			0.002	0.002
	• '		Chemical Total	† •		9E-08		9E-08				0.02	0.02
		Exposure Point Total	Jordan Vota		<u> </u>		·	9E-08			<u> </u>		0.02
·	Exposure	Medium Total						9E-08					0.02
	Groundwater	Site 23	Bromodichloromethane	 		-			NA NA	T		T	
			Chloroform	l	1E-09			1E-09	Liver		0.00007		0.00007
			Tetrachloroethene		4E-11			4E-11	Liver		0.000002		0.000002
			Trichloroethene		1E-09	-		1E-09	Liver, CNS		0.00002		0.00002
			1-Methylnaphthalene			_	_		NA NA		_		
			2-Methylnaphthalene			_			NA.				
	ļ		Benzo(a)anthracene			_	_		NA NA		_		
			Benzo(a)pyrene	l _					NA NA	1			
	1		Benzo(b)fluoranthene	I		-			NA NA		_		
		ľ	Benzo(k)fluoranthene						NA NA				
			Dibenzo(a,h)anthracene					-	NA NA				
		4		1					NA NA		-		
	l		Hexachlorobenzene] -			1 .		NA NA			· · ·	
	_ L	1	Indeno(1,2,3-cd)pyrene	<u> </u>			-		NA NA				

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future

Receptor Population: Construction Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenic	Risk			Non-Carcino	genic Hazard Q		
			Concern	Ingestion	Inhalation	Dermai	External (Radiation)	Exposure Routes Total	Primary. Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Site 23	Naphthalene		••	-	-		NA NA	••	0.0002		0.0002
			Aluminum			-	-		CNS		- 1		
·			Arsenic			_	-		» NA		-		
•			iron			· · -	-	••	NA.		-		
			Manganese	-			_		CNS		- 1		
	-		Vanadium				-		NA.		-		
•			Chemical Total		2E-09		-	2E-09			0.0003		0.0003
		Exposure Point Total						2E-09					0.0003
	Exposure Medium Total							2E-09					0.0003
Medium Total								9E-08					0.02
Receptor Total					***************************************		tor Risk Total	9E-08			Rece	ptor HI Total	0.02

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT

NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk			Non-Carcin	nogenic Hazard	Quotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Site 23	Bromodichloromethane	2E-07	-	1E-09		2E-07	Kidney	0.001		0.00004	0.001
			Chloroform	'	-		-		Liver	0.02		0.0007	0.02
			Tetrachloroethene	2E-06	-	1E-07	-	2E-06	Liver	0.004		0.0007	0.005
			Trichloroethene	2E-06	-	3E-08		2E-06	Liver, Kidney	0.2		0.009	0.2
			1-Methylnaphthalene		-				Lungs	0.01		0.005	0.02
			2-Methylnaphthalene		-		-		Lungs	0.01		0.006	0.02
			Benzo(a)anthracene	2E-05	_			2E-05	NA NA	-			
		,	Benzo(a)pyrene	7E-05			,	7E-05	NA NA				_
			Benzo(b)fluoranthene	1E-05	-			1E-05	NA NA	-			
			Benzo(k)fluoranthene	1E-06	_			1E-06	NA.				_
			Dibenzo(a,h)anthracene	4E-05	_			4E-05	NA .	-			
			Hexachiorobenzene	9E-06	_	4E-06		1E-05	Liver	0.08		0.1	0.2
		•	Indeno(1,2,3-cd)pyrene	5E-06				5E-06	NA NA				
	-		Naphthalene		- 1		_		Body Weight	0.003		0.0006	0.003
			Aluminum		_		-		CNS	0.03	 :	0.00003	0.03
			Arsenic	2E-04	- 1	6E-08	_	2E-04	Skin, CVS	4		0.005	4
			Iron .					••	GS	10		0.01	10
			Manganese		-			••	CNS	3		0.09	3
			Vanadium		_ '				Kidney	0.4		0.02	0.4
			Chemical Total	3E-04	-	4E-06		3E-04		18		0.3	18
•		Exposure Point Total						3E-04		L	· · · · · · · · · · · · · · · · · · ·		18
	Exposure M	ledium Total	·			****		3E-04		· · · · · · · · · · · · · · · · · · ·			18
1	Groundwater	Site 23	Bromodichloromethane		2E-07	-		2E-07	NA NA		0.001		0.001
			Chioroform	-		_			Liver		0.02		0.02
			Tetrachloroethene		2E-06		_	2E-06	Liver		0.004		0.004
· ·			Trichloroethene		2E-06			2E-06	Liver, CNS		0.2		0.2
			1-Methylnaphthalene	_		-			NA.	••	0.01		0.01
			2-Methylnaphthalene			_			NA NA		0.01	•	0.01
			Benzo(a)anthracene			_			NA.				
			Benzo(a)pyrene			-	_		NA.				-
	7.1	•	Benzo(b)fluoranthene	-			_		NA.				-
		·	Benzo(k)fluoranthene			_	_		NA NA				_
			Dibenzo(a,h)anthracene		l		_		NA.		-		_
			Hexachlorobenzene			_	_		NA ·		-		-
			, leverillo opeuseue			-	- 1	1	INA '	•••			

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT

ON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	c Risk	•		Non-Carcin	ogenic Hazard	Quotient	
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Site 23	Naphthalene				-		NA NA	••	0.003	• •	0.003
		1	Aluminum	-		· -		••	CNS				
			Arsenic			-	-	,	. NA		-		_
			Iron				- 1		NA .		_		
			Manganese	-		-	-		CNS	••			_
			Vanadium				-		NA ·		-		
	,		Chemical Total		4E-06			4E-06			0.2		0.2
		Exposure Point Total						4E-06					0.2
	Exposure Medium Total							4E-06			10		0.2
Medium Total								3E-04					19
Receptor Total						Recep	otor Risk Total	3E-04			Rece	ptor HI Total	19

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

Total Body Weight HI	0.003
Total CNS HI	4
Total CVS HI	4
Total GS HI	10
Total Kidney HI	0.5
Total Liver HI	0.6
Total Skin HI	4

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	Risk		Non-Carcinogenic Hazard Quotient					
	;	Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Tota		
oundwater	Groundwater	Site 23	Bromodichloromethane	1E-07	-	9E-09	-	2E-07	Kidney	0.0010	. ••	0.00005	0.001	
			Chloroform		-		· -		Liver	0.02	••	0.0010	0.02	
			Tetrachloroethene	2E-06	-	8E-07		2E-06	Liver	0.003	••	0.001	0.004	
			Trichloroethene	2E-06	- '	2E-07	-	2E-06	Liver, Kidney	0.1		0.01	0.1	
			1-Methylnaphthalene		-	••	-		Lungs	0.008		0.007	0.02	
			2-Methylnaphthalene				-	••	Lungs	0.010		0.009	0.02	
	1		Benzo(a)anthracene	6E-06			-	6E-06	NA.				-	
			Benzo(a)pyrene	3E-05	-		-	3E-05	. NA			-	-	
			Benzo(b)fluoranthene	4E-06			_	4E-06	NA	-		-	-	
			Benzo(k)fluoranthene	4E-07				4E-07	NA NA			-		
	1		Dibenzo(a,h)anthracene	1E-05			_	1E-05	NA NA					
		· ·	Hexachlorobenzene	8E-06	_	3E-05	-	4E-05	Liver	0.05	·	0.2	0.2	
		ļ.	Indeno(1,2,3-cd)pyrene	2E-06			_	2E-06	NA NA	_			_	
			Naphthalene		-	• •	.		Body Weight	0.002		0.0008	0.003	
			Aluminum		_				CNS	0.02		0.00005	0.02	
			Arsenic	2E-04	-	4E-07		2E-04	Skin, CVS	3		0.007	3	
			Iron		_				GS	7		0.01	7	
			Manganese				_		CNS	2		0.1	2	
		* -	Vanadium						Kidney	0.2		0.02	0.3	
			Chemical Total	2E-04		3E-05		3E-04	,	12		0.4	13.	
		Exposure Point Total	12					3E-04					13	
	Exposure M	Nedium Total		3E-04							13			
	Groundwater	Site 23	Bromodichloromethane	_	1E-07	_		1E-07	NA NA		0.0010		0.0010	
			Chloroform		••				Liver		0.02		0.02	
			Tetrachloroethene		2E-06	_		2E-06	Liver		0.003		0.003	
	1		Trichloroethene		2E-06	_	_	2E-06	Liver, CNS	•	0.1		0.1	
			1-Methylnaphthalene				_		NA.		0.008		0.008	
	ŧ.		2-Methylnaphthalene			_	_		NA		0.010		0.010	
			Benzo(a)anthracene			_			NA I		0.010		0.010	
			Benzo(a)pyrene			_			NA NA				_	
			Benzo(b)fluoranthene						NA NA				-	
	1					-			NA NA					
		i .	Donzo/k\fly.oconthono											
	·		Benzo(k)fluoranthene	-			l i							
			Benzo(k)fluoranthene Dibenzo(a,h)anthracene Hexachlorobenzene	-		_	-		NA NA					

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential			Carcinogenio	: Risk			Non-Carcinogenic Hazard Quotient					
			Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total		
Groundwater	Groundwater	Site 23	Naphthalene		••		-	••	NA NA	••	0.002		0.002		
			Aluminum						CNS		.				
	·		Arsenic	-		-	-		NA .						
			Iron			_	_		NA NA				_		
			Manganese	-	••	-	- 1		CNS				_		
			Vanadium			-	_		. NA						
	·		Chemical Total		3E-06	-	- 1	3E-06			0,1		0.1		
		Exposure Point Total						3E-06					0.1		
	Exposure Medium Total					3E-06									
Medium Total								3E-04		0.1 13					
Receptor Total				Receptor Risk Total 3E-04						13					

Note:

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

Total Body Weight HI	0.003
Total CNS HI	3
Total CVS HI	3
. Total GS HI	7
Total Kidney HI	0.4
Total Liver HI	0.5
Total Skin HI	3

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 1 OF 2

Scenario Timeframe: Future Receptor Population: Residents Receptor Age: Lifelong (Child and Adult)

Medium	Exposure	Exposure	Chemical		Non-Carcinogenic Hazard Quotient									
Medidiii	Medium	Point	of Potential			Carcinogenio	RISK		HALL-DELMINAGOIN LIBERIA RODUCIA					
		neuioin Foliit	Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	
Groundwater	Groundwater	Site 23	Bromodichloromethane	3E-07	-	1E-08	- 1	3E-07	•					
			Chloroform		-		_	••			r.			
		15	Tetrachloroethene	3E-06		9E-07	-	4E-06		1				
			Trichloroethene	3E-06		2E-07	-	3E-06				*		
		·	1-Methylnaphthalene		-		-			}				
			2-Methylnaphthalene				-	*,					Ī	
			Benzo(a)anthracene	2E-05			-	2E-05						
			Benzo(a)pyrene	1E-04			-	1E-04		1				
		•	Benzo(b)fluoranthene	1E-05	-		-	1E-05			ļ.			
İ		i.	Benzo(k)fluoranthene	1E-06	-	•	-	1E-06	,					
			Dibenzo(a,h)anthracene	5E-05	-		-	5E-05						
:			Hexachlorobenzene	2E-05	-	3E-05	-	5E-05		İ .				
			Indeno(1,2,3-cd)pyrene	7E-06		••		7E-06						
			Naphthalene		-	••	-	••]			
			Aluminum		-									
			Arsenic	3E-04	_	5E-07	-	3E-04						
			iron				-							
			Manganese					*-						
			Vanadium		-			••						
			Chemical Total	6E-04		4E-05	-	6E-04						
		Exposure Point Total						6E-04						
	Exposure M	fedium Total						6E-04						
	Groundwater	Site 23	Bromodichloromethane	••	3E-07	••	-	3E-07						
			Chioroform			-	-			. * *	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			
			Tetrachloroethene	 ,	3E-06	-	-	3E-06						
			Trichloroethene		3E-06		-	3E-06						
			1-Methylnaphthalene			-		••						
			2-Methylnaphthalene	-		-	-							
		1	Benzo(a)anthracene	-	••			••						
		ļ ,	Benzo(a)pyrene	-		-								
			Benzo(b)fluoranthene	-	••	-	-	••						
	and the second		Benzo(k)fluoranthene	-			- 1			,				
			Dibenzo(a,h)anthracene	-	••	-	-	••						
			Hexachlorobenzene	••	••	•	-							
		l	Indeno(1,2,3-cd)pyrene					••	L					

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs REASONABLE MAXIMUM EXPOSURES - UNDERDRAIN METERING PIT NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 2

Scenario Timeframe; Future Receptor Population: Residents Receptor Age: Lifelong (Child and Adult)

Medium	Exposure Exposure Medium Point		Chemical of Potential			Carcinogenio	: Risk		Non-Carcinogenic Hazard Quotient					
			Concern	Ingestion	Inhalation	Dermal	External	Exposure	Primary	Ingestion	Inhalation	Dermal	Exposure	
							(Radiation)	Routes Total	Target Organ(s)				Routes Total	
Groundwater	Groundwater	Site 23	Naphthalene	-		-	- 1	••						
			Aluminum				-	• •	:					
			Arsenic			-	· -							
			Iron			-								
			Manganese		••	· =	-							
	*		Vanadium	-		-	-							
			Chemical Total		7E-06	-	- 1	7E-06	1					
		Exposure Point Total						7E-06		· · · · · · · · · · · · · · · · · · ·	······································			
	Exposure Medium Total							7E-06						
Medium Total								6E-04						
Receptor Total				·		Recep	tor Risk Total	6E-04						

Note:

Inhalation exposures are assumed to be equal to the exposures from ingestion of groundwater.

APPENDIX E

VAPOR INTRUSION EVALUATION FOR GROUNDWATER MEMORANDUM

From: Bob Jupin, Tetra Tech Risk Assessment Specialist

To: Corey Rich, Tetra Tech Project Manager

Date: May 30, 2008

Regarding: Vapor Intrusion Evaluation for Groundwater at Operable Unit (OU) 9

Groundwater data from Sites 2, 3, 7, 14, 15, 18, 20, and 23 which are within OU 9 were evaluated to determine if there were unacceptable risks associated with vapor intrusion into buildings. The most recent groundwater data that was available for each site was used in the evaluation. Concentrations of volatile organic compounds (VOCs) in groundwater were compared to screening criteria for vapor intrusion. Screening criteria were obtained from USEPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002, CTDEP's Proposed Revisions - Connecticut's Remediation Standard Regulations Volatilization Criteria, March 2003, and USEPA Region I (April 24, 2008). The screening criteria are for residential exposures and are based on an incremental lifetime cancer risk (ILCR) of 1 x 10⁻⁶ or a hazard index (HI) of 1. If the risk-based screening criterion is less than the maximum contaminant level (MCL) the 2002 USEPA guidance recommends using the MCL as the screening level. However, USEPA Region I guidance does not allow for MCLs to be used as screening criteria. USEPA Region I provided risk-based screening levels for those cases where the USEPA draft guidance recommended MCLs as screening levels. If chemicals were detected at concentrations exceeding either screening criteria, then the chemicals were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model (USEPA, February 2004): The results of the screening and modeling evaluations are presented below.

COMPARISON TO SCREENING CRITERIA FOR VAPOR INTRUSION

Site 2

Groundwater data presented in the Year 3 Annual Groundwater Monitoring Report for Area A Landfill (Tetra Tech, 2003) was used to evaluate the potential for vapor intrusion at Site 2. This was the last year that VOCs were analyzed for in groundwater samples collected at Site 2. VOCs were eliminated as a concern at Site 2 after eleven rounds of groundwater monitoring. A comparison of the detected concentrations of VOCs in groundwater samples from upgradient wells, downgradient wells in Area A Downstream, and downgradient wells in the Area A Wetland to the screening criteria are presented in Tables 1 through 3, respectively. Concentrations of all chemicals were below the CTDEP RSRs for vapor intrusion. Concentrations of chloroform exceeded the USEPA screening criterion in samples from upgradient well 4MW01S. Concentrations of trichloroethene exceeded the USEPA screening criterion in samples from upgradient monitoring well 4MW01S; downstream monitoring well 3MW37S, and wetlands monitoring well 2WMW46DS. Concentrations of tetrachloroethene exceeded the USEPA screening

criterion in samples from wetlands monitoring well 2WMW39DS. Therefore, these chemicals were further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Site 3

Groundwater data presented in the Year 1 Annual Groundwater Monitoring Report for Sites 3 and 7 (Tetra Tech, 2007) was used to evaluate the potential for vapor intrusion at Site 3. A comparison of the detected concentrations of VOCs in groundwater samples to the screening criteria is presented in Table 4. Concentrations of chloroform exceeded the USEPA screening criterion in samples from monitoring wells 3MW15S, 3MW15D, 2MW16S, and 3MW16D. Concentrations of trichloroethene exceeded USEPA screening criterion in all four samples collected from monitoring well 2DMW16D. Concentrations of vinyl chloride in monitoring well 2DMW29S exceeded the USEPA screening criterion and CTDEP RSRs in groundwater samples collected during the 1st, 2nd, and 4th quarters. Therefore, chloroform, trichloroethene, and vinyl chloride were further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Site 7

Groundwater data presented in the Year 1 Annual Groundwater Monitoring Report for Sites 3 and 7 (Tetra Tech, 2007) was used to evaluate the potential for vapor intrusion at Site 7. A comparison of the detected concentrations of VOCs in groundwater samples to the screening criterion is presented in Table 5. Concentrations of trichloroethene exceeded the USEPA screening criterion in all four samples collected from monitoring wells 7MW05D and 7MW12I. Therefore, trichloroethene was further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Site 14

No VOCs were detected in groundwater samples collected at Site 14 during the Basewide Groundwater Operable Unit Remedial Investigation (BGOURI) (Tetra Tech, 2002) indicating that vapor intrusion is not a concern at Site 14.

Site 15

Groundwater data presented in the Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (Tetra Tech, 2004) was used to evaluate the potential for vapor intrusion at Site 15. A comparison of the detected concentrations of VOCs in groundwater samples to the screening criteria is presented in Table 6. Chloroform was the only VOC detected in groundwater samples collected at Site 15. Chloroform is a common laboratory contaminant and is frequently detected in potable water samples. Chloroform was only detected in one sample at one temporary monitoring well (15TW03) and the detected concentration exceeded the USEPA screening criterion. Therefore, chloroform was further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Site 18

No VOCs were detected in groundwater samples collected at Site 18 during the BGOURI (Tetra Tech, 2002) indicating that vapor intrusion is not a concern at Site 18.

Site 20

Groundwater data presented in the BGOURI (Tetra Tech, 2002) was used to evaluate the potential for vapor intrusion at Site 20. A comparison of the detected concentrations of VOCs in groundwater samples to the screening criteria is presented in Table 7. 4-Methyl-2-pentanone and trichloroethene were the only VOCs detected in groundwater samples collected at Site 20. Trichloroethene was detected in the groundwater sample from monitoring well 2WCMW2S at a concentration exceeding the USEPA screening criterion. Therefore, trichloroethene was further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

Site 23

Groundwater data presented in Year 1 Annual Monitoring Report for Site 23 Underdrain Metering Pit (Tetra Tech, 2008) was used to evaluate the potential for vapor intrusion at Site 23. A comparison of the detected concentrations of VOCs in groundwater samples to the screening criteria are presented in Table 8. Concentrations of chloroform detected in one sample and trichloroethene detected in four samples exceeded the USEPA screening criterion. Therefore, chloroform and trichloroethene were further evaluated using the Johnson and Ettinger Vapor Intrusion Model.

VAPOR INTRUSION MODELING

The following chemicals were detected at concentrations exceeding the screening criteria for vapor intrusion:

- Site 2 Upgradient chloroform and trichloroethene
- Site 2 Area A Downstream trichloroethene
- Site 2 Area A Wetlands tetrachloroethene and trichloroethene
- Site 3 chloroform, trichloroethene, and vinyl chloride
- Site 7 trichloroethene
- Site 15 chloroform
- Site 20 trichloroethene
- Site 23 chloroform and trichloroethene

These chemicals were further evaluated using USEPA's Johnson and Ettinger Vapor Intrusion Model. There are currently no buildings at any of the sites that are used for residential purposes, although there are some buildings that are used for industrial purposes. Therefore, the evaluation considered a hypothetical scenario where a residential building was constructed at the sites.

In accordance with USEPA Region I guidance (1999), there was not sufficient data available to calculate temporal averages at the monitoring wells; therefore, the maximum detected concentrations were used as the exposure point concentrations for the chemicals identified as exceeding the screening levels at each site. The boring logs for the monitoring wells where there were exceedances of the screening criteria were used to determine the Soil Conservation Services (SCS) soil type. Test results from the BGOURI were used to determine the bulk density and total porosity. The values used in the evaluation are presented in Table 9. Supporting information for Table 9 is included in Attachment A. Slab-on-grade construction was assumed for future residential construction due to the shallow groundwater depth at Site 3. At the Site 2 Wetlands the depth to groundwater was assumed to be 2 feet which represents the average depth to groundwater at monitoring wells 2WMW39DS and 2WMW46DS. At the other sites the shallowest depth to groundwater was used in the evaluation. Default parameters were used for the remaining model input parameters for the evaluation of residential exposures.

The USEPA vapor intrusion guidance does not provide any default parameters for evaluating industrial exposures. The USEPA default values of 250 days a year and 25 years were used for the exposure frequency and exposure duration, respectively (USEPA, December 2002) for industrial exposures. The CTDEP (March 2003) and ASTM (2004) default value of 0.83 hr⁻¹ was used as the air exchange rate and 300 cm was used as the building height. The same input parameters that were used to evaluate residential exposures were used for the remaining input parameters.

Toxicity criteria for trichloroethene are not currently published on the USEPA's IRIS database or in USEPA's Health Effects Assessment Summary Tables (HEAST). USEPA has published draft toxicity criteria for trichloroethene in the *External Review Draft for Trichloroethylene Health Risk Assessment: Synthesis and Characterization* (2001). The draft toxicity criteria are currently undergoing peer review. Alternatively, the California EPA (CA EPA) has developed toxicity criteria for trichloroethene (2002). Both sets of toxicity criteria were used to estimate risks for exposures to trichloroethene. The draft USEPA guidance recommends values of 1.1 x 10⁻⁴ (ug/m³)⁻¹ for the unit risk factor and 0.04 mg/m³ for the reference concentration. CA EPA recommends values of 2.0 x 10⁻⁶ (ug/m³)⁻¹ for the unit risk factor and 0.6 mg/m³ for the reference concentration. As recommended by USEPA Region I, the unit risk factor for adult exposures of 4.4 x 10⁻⁶ (ug/m³)⁻¹ was used for vinyl chloride. The toxicity criteria used in the evaluation are presented in Tables 10 and 11.

The results of the vapor intrusion modeling are summarized in Table 12. Outputs for the Johnson and Ettinger Vapor Intrusion Model are presented in Attachment B.

HIs for residential and industrial exposures to all chemicals at all sites were less than unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions.

Overall the ILCRs for residential and industrial exposures at all sites were less than or within the USEPA target risk range of 10^{-4} to 10^{-6} . ILCRs for residential and industrial exposures were less than or equal to 1×10^{-6} at Site 2 indicating that there is no significant risk from vapor intrusion at this site.

At Site 3 the ILCR for trichloroethene of 3 x 10⁻⁵ for residential exposures and 5 x 10⁻⁶ for industrial exposures based on the draft USEPA toxicity criteria exceeds the CTDEP acceptable level for cumulative exposures and the ILCRs of 7 x 10⁻⁶ for chloroform and 8 x 10⁻⁶ for vinyl chloride exceed the CTDEP acceptable level of 1 x 10⁻⁶ for individual chemicals. The ILCR for trichloroethene for residential exposures based on the Cal EPA toxicity and ILCRs for industrial exposures for trichloroethene, chloroform, and vinyl chloride are all less than or equal to 1 x 10⁻⁶. Vinyl chloride was only detected at monitoring well 2DMW29S and trichloroethene and chloroform were not detected in groundwater samples from this monitoring well. Chloroform was detected in groundwater samples from monitoring wells 3MW15I, 3MW15S, 3MW16D, and 3MW16S. The maximum detected concentration of chloroform occurred at monitoring well 3MW16S. Trichloroethene and vinyl chloride were not detected at this monitoring well. Trichloroethene was detected in groundwater samples from monitoring wells 3MW16D and 2MW16D. At monitoring well 3MW16D, the only monitoring well where trichloroethene and chloroform were both detected, the cumulative ILCR for residential exposures is 2 x 10⁻⁵ based on the draft USEPA toxicity criteria, and 2 x 10⁻⁶ based on the Cal EPA toxicity criteria.

At Site 7 the ILCR for trichloroethene of 2 x 10^{-6} for residential exposures based on the draft USEPA toxicity criteria is less than the CTDEP acceptable level for cumulative exposures but exceeds the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. The ILCR for trichloroethene of 3 x 10^{-7} for industrial exposures based on draft USEPA toxicity criteria and ILCRs for of 2 x 10^{-7} and 3 x 10^{-8} for residential and industrial exposures, respectively, based on the Cal EPA toxicity criteria for trichloroethene are less than the CTDEP acceptable level for individual chemicals. Also the maximum detected concentration of trichloroethene in groundwater samples at Site 7 of 1 μ g/L is less than the residential CTDEP RSR of 27 μ g/L for vapor intrusion.

At Site 15 the ILCR of 4 x 10^{-6} for residential exposures is less than the CTDEP acceptable level for cumulative exposures but exceeds the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. The ILCR of 5 x 10^{-7} for industrial exposures is less than the CTDEP acceptable level for individual chemicals.

Also the maximum detected concentration of chloroform in groundwater samples at Site 15 of 3 μ g/L is less than the residential CTDEP RSR of 26 μ g/L for vapor intrusion.

At Site 20 the ILCR for trichloroethene of 4 x 10^{-6} for residential exposures based on the draft USEPA toxicity criteria is less than the CTDEP acceptable level for cumulative exposures but exceeds the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. The ILCR for trichloroethene of 6 x 10^{-7} for industrial exposures based on the draft USEPA toxicity criteria is less than the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. ILCRs for of 7 x 10^{-8} and 1 x 10^{-8} for residential and industrial exposures, respectively, based on the Cal EPA toxicity criteria for trichloroethene are less than the CTDEP acceptable level for individual chemicals. Also the maximum detected concentration of trichloroethene in groundwater samples at Site 20 of 5.02 μ g/L is less than the residential CTDEP RSR of 27 μ g/L for vapor intrusion.

At Site 23 for residential exposures the ILCR for chloroform of 2 x 10^{-6} and trichloroethene of 4 x 10^{-6} based on the draft USEPA toxicity criteria are less than the CTDEP acceptable level for cumulative exposures but exceeds the CTDEP acceptable level of 1 x 10^{-6} for individual chemicals. The ILCR for trichloroethene for residential exposures based on the Cal EPA toxicity and ILCRs for industrial exposures for trichloroethene and vinyl chloride are all less than 1 x 10^{-6} . Also the maximum detected concentration of chloroform in groundwater samples at Site 23 of 3 μ g/L is less than the residential CTDEP RSR of 26 μ g/L for vapor intrusion.

Preliminary Remediation Goals

The vapor intrusion model was also used to calculate site-specific, risk-based preliminary remediation goals (PRGs) for vapor intrusion at all the sites. The PRGs are presented in Table 13 and are based on a 1 x 10⁻⁶ risk level or a hazard index of 1. The model outputs for the PRGs are included in Attachment B. As recommended by USEPA Region I (April 2008), the PRGs for trichloroethene are based on the Cal EPA toxicity criteria. Also included in Table 13 are USEPA maximum contaminant levels (MCLs) and CTDEP RSRs. These criteria would be considered applicable or relevant and appropriate requirements (ARARs).

The CTDEP RSRs for vapor intrusion were also derived using the Johnson and Ettinger model, although CTDEP uses different input parameters than those recommended by USEPA. The most notable difference is that the CTDEP RSRs for trichloroethene are not risk-based but based on a background air concentration of 1 ug/m³.

Uncertainty Analysis

The results of the vapor intrusion modeling are subject to the following sources of uncertainty:

- The model assumes an infinite source. The sources of VOCs at the sites have been removed and VOCs are no longer being released to groundwater. In addition, concentrations of VOCs in groundwater are decreasing with time.
- The model assumes that the areal extent of contamination is greater than that of the building floor in contact with the soil and that the contamination is homogeneously distributed within the zone of contamination. The groundwater concentrations from a single well were used as the exposure point concentrations for the model. It is not known if the extent of the groundwater plume is larger or smaller than the assumed building foot print.
- The model assumes that the contaminant exposure point concentration is present in groundwater at the soil/groundwater interface. The model does not consider the case when contaminated groundwater is present at depth and a relatively clean layer of groundwater is present at the aquifer surface. In this case, the clean layer of surficial groundwater may slow or restrict the migration of VOC vapors to the unsaturated zone. Modeling was done for several contaminants that were only detected in deep monitoring wells. It was conservatively assumed that these contaminants were present at the same concentrations at the soil/groundwater interface.
- The model does not take into account transformation processes.
- The default building area of 10 meters (32.8 feet) by 10 meters for residential exposures is based on a Michigan study and corresponds to the 10th percentile floor space area for residential single family dwellings. The slab on grade scenario assumes a single floor dwelling 2.44 meters (8 feet) high for residential exposures and 3.0 meters (10 feet) for industrial exposures. The modeling results may be different for a building with different dimensions.
- As discussed above, at present there are no USEPA-approved toxicity criteria for trichloroethene. Risks were calculated in this evaluation using draft toxicity criteria published by USEPA (2001) and toxicity criteria developed by Cal EPA (2002). At the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) meeting in San Diego, California on March 13, 2008, Mary T. Cooke of the USEPA's Federal Facilities Restoration and Reuse Office (FFRRO) announced USEPA provisional guidance for trichloroethene. The provisional guidance is based on the Cal EPA toxicity criteria. According to Cooke's presentation, USEPA is recommending that regulators manage risk within a range of 1 to 10 μg/m³. The provisional guidance has not yet

been officially published. USEPA Region I recommended using the Cal EPA toxicity criteria to develop the PRGs in this evaluation. Risks from trichloroethene that were estimated in this evaluation using the Cal EPA toxicity criteria were within USEPA and CTDEP acceptable levels for both residential and industrial exposures.

SUMMARY AND CONCLUSIONS

Site 2

Concentrations of chloroform, tetrachloroethene, and trichloroethene exceeded the USEPA screening criterion at Site 2. These chemicals were further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA and CTDEP acceptable levels at Site 2. Further evaluation against PRGs and ARARs showed that vapor intrusion is not an issue at Site 2. No further action is required for vapor intrusion issues.

Site 3

Concentrations of chloroform, trichloroethene, and vinyl chloride exceeded USEPA screening criterion at Site 3. Concentrations of vinyl chloride also exceed the residential CTDEP RSR for vapor intrusion at Site 3. These chemicals were further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA acceptable levels. Cancer risks for chloroform and vinyl chloride for residential exposures exceeded the CTDEP acceptable risk levels. Cancer risks for trichloroethene based upon Cal EPA toxicity criteria were within CTDEP acceptable levels for residential and industrial scenarios but cancer risks based upon draft EPA toxicity criteria exceeded CTDEP acceptable levels.

The maximum detected concentration of chloroform exceeds the site-specific PRG for residential exposures but is less than the site-specific PRG for industrial exposures, USEPA MCL, and the CTDEP RSRs for vapor intrusion for chloroform. Because the modeling only showed potential cancer risks exceeding CTDEP acceptable levels and the maximum concentration did not exceed the CTDEP RSRs for vapor intrusion, it is concluded that there are no vapor intrusion issues associated with chloroform and no further action is required.

The maximum detected concentration of trichloroethene exceeds the USEPA MCL but is less than the site-specific PRGs and CTDEP RSRs for vapor intrusion. A groundwater monitoring program and land use controls are in place to address the exceedance of the USEPA MCL for trichloroethene. No further action is required for vapor intrusion issues.

The maximum detected concentration of vinyl chloride exceeds the USEPA MCL, site-specific PRGs, and residential CTDEP RSR for vapor intrusion. A groundwater monitoring program and land use controls are in place to address the exceedance of the USEPA MCL for vinyl chloride. Considering the CTDEP RSRs for vapor intrusion, the vinyl chloride concentration detected in groundwater at monitoring well 2DMW29S does not represent a vapor intrusion issue under the current industrial scenario, but may be an issue under a future residential scenario. A building could be constructed in the vicinity of monitoring well 2DMW29S for industrial purposes; however, there would be restrictions on construction of a building within 100 feet of the well for residential use unless steps were taken to mitigate the vapor intrusion issue. The current Site 3 land use control document should be amended to include controls to address vapor intrusion issues at well 2DMW29S until groundwater concentrations are reduced to levels where vapor intrusion is no longer deemed an issue.

Site 7

Concentrations of trichloroethene exceeded the USEPA screening criterion at Site 7. Trichloroethene was further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks and hazard indices for residential and industrial scenarios were within USEPA acceptable levels. Cancer risks based upon Cal EPA toxicity criteria were within CTDEP acceptable levels for residential but cancer risks based upon draft USEPA toxicity criteria exceeded CTDEP acceptable levels. Further evaluation against PRGs and ARARs showed that vapor intrusion is not an issue at Site 7. No further action is required for vapor intrusion issues.

Site 15

Concentrations of chloroform in one sample exceeded the USEPA screening criterion at Site 15. Chloroform was further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks under a residential scenario were within USEPA acceptable levels but exceeded CTDEP acceptable levels. Cancer risks for an industrial scenario were within USEPA and CTDEP acceptable levels. Further evaluation against ARARs showed that vapor intrusion is not an issue at Site 15. No further action is required for vapor intrusion issues.

Site 20

Concentrations of trichloroethene exceeded the USEPA screening criterion at Site 20. Trichloroethene was further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks based upon Cal EPA toxicity criteria were within USEPA and CTDEP acceptable levels for residential and industrial scenarios but cancer risks for a residential scenario based upon draft USEPA toxicity criteria exceeded CTDEP acceptable levels. Further evaluation against PRGs and ARARs showed that vapor intrusion is not an issue at Site 20. No further action is required for vapor intrusion issues.

Site 23

Concentrations of chloroform and trichloroethene exceeded the USEPA screening criterion at Site 23. Chloroform and trichloroethene were further evaluated using the Johnson and Ettinger Vapor Intrusion Model. Modeling results showed that cancer risks for chloroform under a residential scenario were within USEPA acceptable levels but exceeded CTDEP acceptable levels. Cancer risks for trichloroethene based upon Cal EPA toxicity criteria were within USEPA and CTDEP acceptable levels for residential and industrial scenarios but cancer risks for a residential scenario based upon draft USEPA toxicity criteria exceeded CTDEP acceptable levels. Further evaluation against ARARs showed that vapor intrusion is not an issue at Site 23. No further action is required for vapor intrusion issues.

References

ASTM (American Society for Testing and Materials), 2004. E 2081 Standard Guide for Risk-Based Corrective Action.

California Environmental Protection Agency (Cal EPA), 2002. Toxic Support Document for Describing Available Cancer Potency Factors. Air Toxics Hot Spots Program Risk Assessment Guidelines. Office of Environmental Health Hazard Assessment, December.

Connecticut Department of Environmental Protection (CTDEP), 2003. Proposed Revision, Connecticut's Remediation Standard Regulations, Volatilization Criteria. Bureau of Water Management, Permitting, Enforcement and Remediation Division, Hartford. Connecticut. March.

Tetra Tech (Tetra Tech NUS, Inc.), 2002. Basewide Groundwater Operable Unit Remedial Investigation, Naval Submarine Base - New London, Groton, Connecticut. King of Prussia, Pennsylvania, January.

Tetra Tech, 2003. Year 3 Annual Groundwater Monitoring Report for Area A Landfill, Naval Submarine Base - New London, Groton, Connecticut. King of Prussia, Pennsylvania. July.

Tetra Tech, 2004. Basewide Groundwater Operable Unit Remedial Investigation Report Update/Feasibility Study Report, Naval Submarine Base - New London, Groton, Connecticut. King of Prussia, Pennsylvania, July.

Tetra Tech, 2007. Year 1 Annual Groundwater Monitoring Report for Sites 3 and 7, Naval Submarine Base - New London, Groton, Connecticut. King of Prussia, Pennsylvania. September.

Tetra Tech, 2008. Letter Year 1 Annual Monitoring Report for Site 23 Underdrain Metering Pit, Naval Submarine Base New London, Groton, Connecticut. King of Prussia, Pennsylvania. May.

USEPA Region I, 1999. Risk Updates, Number 5. Waste Management Division, Boston, Massachusetts. September.

USEPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion into Indoor Air. Office of Solid Waste and Emergency Response. EPA 530-F-02-052. November.

USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. Office of Solid Waste and Emergency Response, Washington, D.C., December.

USEPA, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response, Washington, DC, Revised February 22.

USEPA, 2008. EPA Comments on the Basewide Groundwater Vapor Intrusion Analyses. Email from Kymberlee Kecker of USEPA Region I to Corey Rich of Tetra Tech NUS, Inc. April 24.

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 2 - UPGRADIENT MONITORING WELLS VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater

Exposure Point: Upgradient Monitoring Wells (Site 2)

		Minimum	<u> </u>			т		,							
CAS Number		Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency		Concentration Used for	Background			COPC	
Volatile Organic Con	npounds	L			L	<u> </u>	<u> </u>	"		Screening ⁽³⁾	Value ⁽⁴⁾	Volatilization	Volatilization	Flag	Deletion or
75-35-4	1,1-Dichloroethene	1							L			Criteria ⁽⁵⁾	Criteria ⁽⁶⁾		Selection ⁽⁷⁾
	Acetone	10		1	J	ug/L	2LGW20S-03	1/18	1		NA I				
	Carbon Disulfide	0.9		10	J	ug/L	4GW01S-10	1/15	5	10	NA NA	190 N	190	No	BSL
	Chloroform	1		- 2		ug/L	4GW01S-10	1/18	1-2	2	NA NA	220000 N	50000	No	BSL
74-87-3	Chloromethane	0.6				ug/L	4GW01S-02	1/18	1-3	1	NA NA	560 N	NA NA	No	BSL
127-18-4	Tetrachloroethene	0.11		0.6	J	ug/L	4GW01S-09	1/18	7	0.6	NA NA	0.71 C ⁽⁸⁾	26	Yes	ASL
79-01-6	Trichloroethene	0.9		0.11	J	ug/L	4GW01S-05	1/18	- i - l	0.11	NA NA	6.7 C	390	No	BSL
		0.9	<u> </u>	0.9	J	ug/L	4GW01S-08-D	1/18	1 1	0.9		0.55 C	340	No	BSL
Notes:									1	0.9	NA	0.05 C(8)	27	Vec	ACI

Notes:

Data is from the Year 3 Annual Groundwater Monitoring Report for Area A Landfill (Tetra Tech, 2003). 1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.

2 - Values presented are sample-specific quantitation limits.

3 - The maximum detected concentration is used for screening purposes.

4 - No background data is available for VOCs.

- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).

8 - USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Associated Samples

2LGW20S-11	4GW01S-07-D
4GW01S-01	4GW01S-08
4GW01S-01-D	4GW01S-08-D
4GW01S-02	4GW01S-09
4GW01S-03	4GW01S-09-D
4GW01S-04	4GW01S-10
4GW01S-05	4GW01S-10-D
4GW01S-06	4GW01S-11
4GW01S-06-D	4GW01S-11-D
4GW01S-07	-awo13-11-0
	4GW01S-01 4GW01S-01-D 4GW01S-02 4GW01S-03 4GW01S-04 4GW01S-05 4GW01S-06 4GW01S-06-D

<u>Definitions:</u>
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered. C = Carcinogen.
COPC = Chemical of Potential Concern.

J ≈ Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 2 - DOWNGRADIENT MONITORING WELLS IN AREA A DOWNSTREAM VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point: Downgradient Monitoring Wells In Area A Downstream (Site 2)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency		Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria ⁽⁶⁾			Rationale for Contaminant Deletion or Selection ⁽⁷⁾
Volatile Organic Co								' 				Citteria	Criteria		Selection
	Carbon Disulfide	0.2	J	2.2		ug/L	3GW37S-08	2/17		0.0				,	
156-59-2	cis-1,2-Dichloroethene	0.14		0.4						2.2	NA	560 N	NA NA	No I	BSL
	Toluene	0.1.		0.4		ug/L	3GW37S-03	5/17	1 .	0.4	NA NA	210 N	830	No	BSL
		0.1		U.1	J	ug/L	3GW37S-03	1/17	. 1	0.1	NA	1500 N	7100	No	BSL
	trans-1,2-Dichloroethene	0.2	i	0.2	J	na/F	3GW37S-03	1/17	1	0.2	NA	180 N	1000	Nie	
79-01-6	Trichloroethene	0.58	J	2		ug/L	3GW37S-03	9/17		7.5			1000	No	BSL
						192	3443/3-03	9/1/	1	1 2	NA NA	0.05 C(8)	27	Yes	ASL

Data is from the Year 3 Annual Groundwater Monitoring Report for Area A Landfill (Tetra Tech, 2003).

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- 8 USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC

Associated Samples

3GW-12D-01	3GW-12S-01	3GW37S-02	3GW37S-08
3GW-12D-01-D	3GW-12S-02	3GW37S-03	3GW37S-09
3GW-12D-02	3GW-12S-02-D	3GW37S-04	3GW37S-10
3GW-12D-03	3GW-12S-03	3GW37S-05	3GW37S-11
3GW-12D-03-3D	3GW-12S-03-D	3GW37S-06	3GW12D-11
3GW-12D-04	3GW37S-01	3GW37S-07	

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.
COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 2 - DOWNGRADIENT MONITORING WELLS IN AREA A WETLAND VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point: Downgradient Monitoring Wells In Area A Wetland (Site 2)

CAS Number	Chemical	Minimum Concentration	Minimum Qualifler	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria(6)	CTDEP Groundwater Volatilization Criteria ⁽⁶⁾		Rationale for Contaminant Deletion or Selection ⁽⁷⁾
olatile Organic Cor													<u> </u>		Selection
	2-Butanone	1	J	26		ug/L	2WGW39DS-04	20/61	1 - 25	26	NA	440000 N	NA NA	No I	BSL
	Acetone	2	J	120		ug/L	2WGW39DS-04	26/79	5 - 31	120	NA	220000 N	50000	No	BSL
	Benzene	0.2	J	0.3	J	ug/L	2WGW42DS-10	2/99	1-5	0.3 .	NA.	1.36 C	130	No	BSL
	Carbon Disulfide	0.2	J	7.6		ug/L	2WGW43DS-07	58/99	1 - 13	7.6	NA NA	560 N	NA NA	No	BSL
74-87-3	Chloromethane	0.8	J	0.8	J	ug/L	2WGW44DS-09	1/99	1-5	0.8	NA NA	6.7 C			
100-41-4	Ethylbenzene	0.3	J	0.3	i i	ug/L	2WGW39DS-04	1/99	1-5	0.3	NA NA		390	No	BSL
75-09-2	Methylene Chloride	0.5	J	1.2	1	ug/L	2WGW39DS-07	6/99	1-10			6.91 N ⁽⁸⁾	2700	No	BSL
127-18-4	Tetrachloroethene	0.3		1 4		ug/L	2WGW39DS-07	2/99		1.2	NA NA	58 C	160	No	BSL
						ugr	2WGW39DS-03.	2/99	1.5	1.4	NA .	0.55 C ⁽⁸⁾	340	Yes	ASL
	Toluene	0.17	J.	4		ug/L	2WGW39DS-03, 2WGW39DS-09	17/99	1 - 5	4	NA .	1500 N	7100	No	BSL
	Total Xylenes	0.6	J	0.6	J	ug/L	2WGW42DS-09	1/89	1 - 5	0.6	NA NA	22000 N	8700	No	BSL
79-01-6	Trichloroethene	1.2		1.4		ug/L	2WGW46DS-07	2/99	1-5	1.4	NA ·	0.05 C ⁽ⁱⁱ⁾	27	Yes	ASL

Notes:

Data is from the Year 3 Annual Groundwater Monitoring Report for Area A Landfill (Tetra Tech, 2003).

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- 8 USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

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Rationale Codes:

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ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 3 VAPOR INTRUSION NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Site 3

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾		Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria ⁽⁶⁾	CTDEP Groundwater Volatilization Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁷⁾
olatile Organic C						***************************************						O) Itelia	Criteria		Selection
79-34-5	1,1,2,2-Tetrachloroethane	0.33	J	0.33	J	ug/L	S3GW2DMW16D01	1/36	0.5 - 1	0.33	NA	3 C	1.8	No	BSL
75-27-4	Bromodichloromethane	0.5	J	1.8		ug/L	S3GW3MW16D01	4/36	0.5 - 1	1.8	NA NA	2.1 C	NA NA	No	BSL
124-48-1	Chlorodibromomethane	0.76		0.76	· · · · · · · · · · · · · · · · · · ·	ug/L	S3GW3MW16D01	1/36	0.5 - 1	0.76	NA.	3.2 C	NA NA	No	BSL
67-66-3	Chloroform	0.6		15		uo/L	S3GW3MW16S01	11/36	0.5 - 7.3	15	NA NA	0.71 C ⁽⁰⁾	26	Yes	ASL
156-59-2	cis-1,2-Dichloroethene	2		6		ug/L	S3GW2DMW29S02, S3GW2DMW29S02-D	11/36	0.5 - 1	6	NA NA	210 N	830	No	BSL
127-18-4	Tetrachloroethene	0.33	J	0.33	J	ug/L	S3GW3MW16S01	1/36	0.5 - 1	0.33	NA	0.55 C ⁽⁸⁾	340	No	BSL
108-88-3	Toluene	0.33	J	51		ua/L	S3GW2DMW28D02	4/36	0.5 - 1	51.	NA NA	1500 N	7100	No	BSL
1330-20-7	Total Xylenes	0.6	J	0.6	J	ug/L	S3GW2DMW28D02, S3GW2DMW28D03	2/36	0.5 - 1	0.6	NA NA	22000 N	8700	No	BSL
156-60-5	trans-1,2-Dichloroethene	0.33	J	0.5	J	ug/L	S3GW2DMW16S04	2/36	0.5 - 1	0.5	NA NA	180 N	1000	No	BŠL
79-01-6	Trichloroethene	2		7		ug/L	S3GW2DMW16D02, S3GW2DMW16D03, S3GW2DMW16S04	8/36	0.5 - 1	7	NA NA	0.05 C ⁽⁸⁾	27	Yes	ASL
75-01-4	Vinyl Chloride	1.7		10		uo/L	S3GW2DMW29S02-D	3/36	0.5 - 1	10	NA .	0.5 C ⁽⁸⁾	1.6	Yes	ASL

Data is from the Year 1 Annual Groundwater Monitoring Report for Sites 3 and 7 (Tetra Tech, 2007).

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 · Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- 8 USEPA Region I target level.
- A shaded value indicates that the concentration used for screening exceeds the criterion or background value.
- A shaded chemical name indicates that the chemical has been selected as a COPC.

Associated Samples	
S3GW2DMW16D01	S3GW2DMW29S03
S3GW2DMW16D02	S3GW2DMW29S04
S3GW2DMW16D03	S3GW3MW15I01
S3GW2DMW16D04	S3GW3MW15I02
S3GW2DMW16S01	S3GW3MW15I03
S3GW2DMW16S02	S3GW3MW15I04
S3GW2DMW16S03	S3GW3MW15S01
S3GW2DMW16S04	S3GW3MW15S02
S3GW2DMW25S01	S3GW3MW15S03
S3GW2DMW25S02	S3GW3MW15S04
S36W2DMW25S03	S3GW3MW16D01
S3GW2DMW25504	S3GW3MW16D02
S3GW2MW28D01	S3GW3MW16D03
S3GW2DMW28D02	S3GW3MW16D04
S3GW2DMW28D03	S3GW3MW16S01
S3GW2DMW28D04	S3GW3MW16S02
S3GW2DMW29S01	S3GW3MW16S03
\$3GW2DMW29S02	S3GW3MW16S04

<u>Definitions:</u>
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.
COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 7 VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point: Site 7

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency		Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria ⁽⁵⁾	CTDEP Groundwater Volatilization Criteria ⁽⁶⁾		Deletion or
												Cilteria	Criteria		Selection ⁽⁷⁾
	1,1,2-Trichlorotrifluoroethane	0.58	L	0.58		ug/L	S7GW7MW12I01	1/7	0.5	0.58	NA	1500 N			
75-34-3	1,1-Dichloroethane	0.32	L L	0.77		ua/L	\$7GW7MW12I01	5/28	0.5 - 1	0.77	NA NA		NA NA	No	BSL
108-90-7	Chlorobenzene	1	J	2		ug/L	S7GW7MW12S03, S7GW7MW12S04	4/28	0.5 - 1	2	NA NA	2200 N 390 N	3000 1800	No No	BSL BSL
	cis-1,2-Dichloroethene	0.32	J	0.6	J	ug/L	\$7GW7MW12S03, \$7GW7MW12I01	3/28	0.5 - 1	0.6	NA	210 N	- 830	No	BSL
156-60-5	trans-1,2-Dichloroethene	1	J	1	J	ug/L	S7GW7MW12l03	1/28	0.5 - 1						
79-01-6	Trichloroethene	0.7	J	1		ug/L	\$7GW7MW5D02, \$7GW7MW5D03, \$7GW7MW12I03	8/28	0.5 - 1	1	NA NA	0.05 C ⁽⁸⁾	1000	No Yes	BSL_ ASL

Data is from the Year 1 Annual Groundwater Monitoring Report for Sites 3 and 7 (Tetra Tech, 2007).

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.

4 - No background data is available for VOCs.

- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).

8 - USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Associated Samples

Hosociated Sainble	2
S7GW7MW1D01	S7GW7MW5D03
S7GW7MW1D02	S7GW7MW5D04
S7GW7MW1D03	\$7GW7MW9S01
S7GW7MW1D04	S7GW7MW9S02
S7GW7MW3i01	S7GW7MW9S03
S7GW7MW3I02	S7GW7MW9S04
S7GW7MW3I03	S7GW7MW12I01
S7GW7MW3104	S7GW7MW12I02
57GW7MW3S01	S7GW7MW12I03
S76W7MW3502	S7GW7MW12I04
57GW7MW3503	S7GW7MW12S01
S7GW7MW3S04	S7GW7MW12S02
S7GW7MW5D01	S7GW7MW12S03
S7GW7MW5D02	S7GW7MW12S04

<u>Definitions:</u>
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.
COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 15

VAPOR INTRUSION NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Site 15

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units		Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization	CTDEP Groundwater Volatilization	COPC	Rationale for Contaminant Deletion or
Volatile Organi 67-66-3	Chloroform							<u> </u>	L	- Condoming		Criteria(5)	Criteria(6)		Selection ⁽⁷⁾
	- Children	3		3	L	UG/L	S15GW15TW301	1/6	1	3	N/A	0.71 N ⁽⁸⁾	26	Voc	461

- Data is from the Basewide Groundwater Operable Unit Remedial Investigation Report Update/Feasibility Study Report (Tetra Tech, 2004).
- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations. 2 - Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- 8 USEPA Region I target level.
- A shaded value indicates that the concentration used for screening exceeds the criterion or background value.
- A shaded chemical name indicates that the chemical has been selected as a COPC .

Associated Samples:

S15GW15MW1S02

S15GW15MW2S02

S15GW15MW2S02-D

S15GW15MW3S02

S15GW15TW101 S15GW15TW201

\$15GW15TW301

<u>Definitions:</u>
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 20 VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater

Exposure Point: Area A Weapons Center (Site 20)

					-										
CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	I Hange of	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria ⁽⁵⁾	CTDEP Groundwater Volatilization Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁷⁾
Volatile Organic Con										**************************************					
	4-Methyl-2-Pentanone	1.29	J	1.29	J	ug/L	S202WCMW2S01	1/4	5	1.29	N/A	14000 N	13000	No	NTX
79-01-6	Trichloroethene	3.8	J	5.02	J	ug/L	S202WCMW2S01	2/4	1	5.02	N/A	0.05 C ⁽⁸⁾	27	Yes	ASL

- Data is from the Basewide Groundwater Operable Unit Remedial Investigation Report (Tetra Tech, 2001).
- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 · Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002, EPA530-F-02-052, Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, March 2003.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAP/TBC(s).
- 8 USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Associated Samples:

S202WCMW1S01

S202WCMW2S01

S202WCMW3S01

S202WMW4D01

<u>Definitions:</u>
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN AT SITE 23 - UNDERDRAIN METERING PIT VAPOR INTRUSION

NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point: Underdrain Metering Pit (Site 23)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	USEPA Groundwater Volatilization Criteria ⁽⁵⁾	CTDEP Groundwater Volatilization Criteria ⁽⁶⁾		Rationale for Contaminant Deletion or Selection ⁽⁷⁾
/olatile Organic Co											***************************************				
71-43-2	Benzene	0.2	J	0.2	J	ug/L	S23GWMPM04	1/4	0.5	0.2	NA	1.4 C(8)	130	No	BSL
	Bromodichloromethane	0.3	j	0.3	J	ug/L	S23GWMPM01	1/4	0.5	0.3	NA	2.1 C	2.3	No	BSL
110-82-7	Cyclohexane	0.1	J	0.1	J	ug/L	S23GWMPM02	1/4	0.5	0.1	NA NA	NA	NA NA	No	NTX
67-66-3	Chloroform	2	J	3	J	ug/L	S23GWMPM01	1/4	0.5	3 :	NA NA	0.71 C ⁽⁸⁾	26	Yes	ASL
156-59-2	cis-1,2-Dichloroethene	0.2	J	0.3	J	ug/L	S23GWMPM01, S23GWMPM02	4/4	0.5	0.3	NA	210 N	830	No	BSL
98-82-8	isopropyibenzene	0.09	J	0.1	j	ug/L	S23GWMPM01, S23GWMPM02	2/4	0.5	0.1	NA	8.4 N	NA	No	BSL
1634-04-4	Methyl Tert-Butyl Ether	0.4	Ĵ	1		ug/L	S23GWMPM01	4/4		1	NA NA	120000 N	21000	No	BSL
127-18-4	Tetrachtoroethene	0.2	J	0.4	j	ug/L	S23GWMPM02	4/4	-	0.4	NA NA	0.55 C ⁽⁶⁾	340	No	BSL
79-01-6	Trichloroethene	0.3	J	0.5	J	ug/L	S23GWMPM02	4/4		0.5	NA	0.05 C(8)	27	Yes	ASL

Data is from the Year 1 Annual Monitoring Report for Site 23 Underdrain Metering Pit (Tetra Tech, 2008).

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 No background data is available for VOCs.
- 5 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0,001.
- 6 Connecticut's Proposed Revisions Remediation Standard Regulations, Volatilization Criteria, Residential, March 2003,
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- 8 USEPA Region I target level.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Associated Samples

S23GWMPM01

S23GWMPM01-D

S23GWMPM02

S23GWMPM-03

S23GWMPM02-D

S23GWMPM04

<u>Definitions:</u>

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.
COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

MCL = Federal Maximum Contaminant Level

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No toxicity criteria available.

TABLE 9 INPUT PARAMETERS FOR THE VAPOR INTRUSION MODEL NSB-NLON, GROTON, CONNECTICUT

Site and Well	Depth to Groundwater	Depth to Groundwater	Soil Type	Soil Type Used	Dry Bulk Density	Total	Screened Interval	
	(feet bgs)	Used in Model		in Model	(gm/cm ³)	Porosity	(feet bgs)	Reference
2					(gill/cm)	L		
Upgradient								
4MW01S	6.3 to 9.9	6.3 feet (190 cm)	Bedrock w/ gravel and silty sand above	Sandy Loam (SL)	1.8	0.33	8 to 18	V
				1 - a.i.a) acam (CE)	1.0	0.55	1 01016	Year 3 GMR for Area A Landfill, Rounds 9 through 11, 12/2002 to 9/2002
Downstream								
3MW37S	3.61 to 3.79	3.6 feet (110 cm)	Silty Sand w/ trace rock fragments	Sandy Loam (SL)	1.8	0.33	4.5 to 5.5	Voor 2 CMD for Asso A Landill D
				1) (0-/		0.00	4.5 (0 5.5	Year 3 GMR for Area A Landfill, Rounds 9 through 11, 12/2002 to 9/2002
Wetlands								
2WMW39DS	2.4 to 3.4	2.1 feet (65 cm)	Org. Clayey Silt		Default	Default	4 to 14	Voor 2 CMD for Arra A Landin D
2WMW46DS	1.55 to 2.28	2.11661 (00 011)	Org. Clayey Silt	Clay Loam (CL)	Default	Default	4 to 14	Year 3 GMR for Area A Landfill, Rounds 9 through 11, 12/2002 to 9/2002
					- Column	Doradit	41014	Year 3 GMR for Area A Landfill, Rounds 9 through 11, 12/2002 to 9/2002
3	·							
3MW15I	30.9	_	Sand and Gravel		1.8	0.33	55 to 65	Rnd 4, Year 1 GMR for Sites 3 and 7
3MW15S	29.4	1	Sand and Gravel	1	1.8	0.33	28 to 38	Rnd 4, Year 1 GMR for Sites 3 and 7
3MW16D	22.1	3.6 feet (110 cm)	Bedrock w/ sand and cobbles above	04(0)	1.8	0.33	59 to 69	Rnd 4, Year 1 GMR for Sites 3 and 7
3MW16S	14.4	1	Bedrock w/ sand and cobbles above	Sand (S)	1.8	0.33	17 to 27	Rnd 4, Year 1 GMR for Sites 3 and 7
2DMW16D	3.7	4	Bedrock w/ sand, silt, and cobbles above	1 !	1.8	0.33	18 to 60	Rnd 4, Year 1 GMR for Sites 3 and 7
2DMW29S	8.6	<u> </u>	Sand	1	1.8	0.33	6 to 16	Rnd 4, Year 1 GMR for Sites 3 and 7
_							0,0,0	Trid 4, Tear 1 Givin for Sites 3 and 7
7								
7MW05D	12.4	5 feet (150 cm)	Bedrock w/ silty sand w/ trace gravel above	Loamy Sand (LS)	1.6	0.37	32 to 42	Rnd 4, Year 1 GMR for Sites 3 and 7
7MW12I	5		Sandy silt	Loamy Sand (LS)	1.6	0.37	20 to 30	Rnd 4, Year 1 GMR for Sites 3 and 7
4.0							33,10,00	Tind 4, Teal 1 Givin for Siles 3 and 7
15 15TW03								
1514403	6.5	6.5 feet (200 cm)	Sandy silt	Loamy Sand (LS)	1.5	0.45	5 to 15	BGOURI Update/FS
. 00								BOOOTH Opdate/13
20 2WCMW2S	4.0							
2WCMW2S 2WCMW4D	4.6	4.6 feet (140 cm)	Silty sand w/ granite fragments	Sandy Loam (SL)	1.6	0.37	4 to 14	BGOURI Update/FS
200010040	6.1	L	Bedrock	Sandy Loam (SL)	1.6	0.37	13 to 119	BGOURI Update/FS
23								DOOTH OPARON O
23MP01	7 to 9	75						
ZOWFUI	7 10 9	7 feet (210 cm)	Silty sand	Sandy Loam (SL)	1.5	0.45	HNUS 23 (7 to 17)	BGOURI
Other Information								3300.11
	Dulk Danais	Bulle Danell						
Site	Bulk Density	Bulk Density	Porosity	Reference				
<u>a</u>	(lb/cf)	(g/cm³)						
3 7	112.22	1.8	0.3306	BGOURI				
23	98.77	1.6	0.374	BGOURI				
23	90.8	1.5	0.445	BGOURI				

TABLE 10 NON-CANCER TOXICITY DATA -- INHALATION NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Chronic/ Subchronic	Inhala	tion RfC	Extrapo	lated RfD ⁽¹⁾	Primary Target	Combined Uncertainty/Modifying	RfC : Target Organ(s)		
Concern		Value	Units	Value	Units	Organ(s)	Factors	Source(s)	Date(s) (MM/DD/YYYY)	
Volatile Organic Compounds										
Chloroform	Chronic	4.9E-02	mg/m³	1.4E-02	(mg/kg/day)	Liver	NA	USEPA III	10/11/2007	
Tetrachloroethene	Chronic	2.8E-01	mg/m³	8.0E-02	(mg/kg/day)	Liver	NA NA	USÉPA III	10/11/2007	
Trichloroethene - Draft EPA	Chronic	3.5E-02	mg/m³	1.0E-02	(mg/kg/day)	Liver, CNS	NA NA	USEPA(1)	8/2001	
Trichloroethene - Cal EPA	Chronic	6.0E-01	mg/m3	1.7E-01	(mg/kg/day)	Liver, CNS	NA NA	CA EPA	12/2002	
Vinyl Chloride	Chronic	1.0E-01	mg/m³	2.9E-02	(mg/kg/day)	Liver	30/1	IRIS	5/02/2008	

Notes:

1 - Extrapolated RfD = RfC *20m3/day / 70 kg

Definitions:

CNS = Central Nervous System

EPA III = U.S. EPA Region 3 RBC Table, October 11, 2007.

IRIS = Integrated Risk Information System

NA = Not available.

USEPA(1) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

Cal EPA = California EPA, Technical Support Document for Describing Available Cancer Potency Factors, December 2002.

TABLE 11 CANCER TOXICITY DATA -- INHALATION NSB-NLON, GROTON, CONNECTICUT

Chemical of Potential	Uni	t Risk	1	on Cancer Factor ⁽¹⁾	Weight of Evidence/ Cancer Guideline	Unit Risk : Inhalation CSF			
Concern	Value	Units	Value	Units	Description	Source(s)	Date(s) (MM/DD/YYYY)		
Volatile Organic Compounds									
Chloroform	2.3E-05	(ug/m ³) ⁻¹	8.1E-02	(mg/kg/day) ⁻¹	B2	IRIS	5/02/2008		
Tetrachloroethene	5.9E-06	(ug/m ³) ¹	2.1E-02	(mg/kg/day) ⁻¹	NA	USEPA(1)	6/12/2003		
Trichloroethene - Draft EPA	1.1E-04	(ug/m ³) ⁻¹	4.0E-01	(mg/kg/day) ⁻¹	С	USEPA(2)	8/2001		
Trichloroethene - Cal EPA	2.0E-06	(ug/m3)-1	7.0E-03	(mg/kg/day)-1	С	CA EPA	12/2002		
Vinyl Chloride (adult)	4.4E-06	(ug/m³) ⁻¹	1.5E-02	(mg/kg/day) ⁻¹	A	IRIS	5/02/2008		

Notes:

1 - Inhalation CSF = Unit Risk * 70 kg / 20m3/day.

Definitions:

IRIS = Integrated Risk Information System.

NA = Not Available.

USEPA(1) = OSWER Directive No.9285.7-75.

USEPA(2) = Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization, August 2001.

EPA Group:

A - Human carcinogen.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .

C - Possible human carcinogen.

TABLE 12 SUMMARY OF VAPOR INTRUSION MODELING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 12 OF 15

	Site 2 -	Area A - Up	gradient	Site 2 - /	Area A - Dov	vnstream	Site 2 - Area A - Wetlands			
Chemical	EPC	Cancer	Hazard	EPC	Cancer	Hazard	EPC	Cancer	Hazard	
	(ug/L)	Risk	Index	(ug/L)	Risk	Index	(ug/L)	Risk	Index	
	Residential			Residential				Residential		
Chloroform	1	5E-08	1E-04	NA	NA	NA	NA	NA	NA	
Tetrachloroethene	NA	NA	NA	NA	NA	NA	1.4	8E-08	1E-04	
Trichloroethene - EPA Toxicity Criteria	0.9	2E-07	1E-04	2	4E-07	3E-04	1.4	1E-06	6E-04	
Trichloroethene - Cal EPA Toxicity Criteria	0.9	3E-09	7E-06	2	8E-09	2E-05	1.4	2E-08	4E-05	
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	
		Industrial		Industrial			Industrial			
Chloroform	1	7E-09	2E-05	NA	NA	NA	NA	NA	NA	
Tetrachloroethene	NA	NA	NA	NA	NA	NA	1.4	1E-08	2E-05	
Trichloroethene - EPA Toxicity Criteria	0.9	2E-08	1E-05	2	6E-08	5E-05	1.4	2E-07	1E-04	
Trichloroethene - Cal EPA Toxicity Criteria	0.9	5E-10	1E-06	2	1E-09	3E-06	1.4	3E-09	6E-06	
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Notes:

NA - Not a COPC at this site.

EPC = Exposure point concentration, maximum detected concentration of a chemical at a site.

Shading indicates an exceedance of USEPA and/or CTDEP acceptable risk levels.

TABLE 12 SUMMARY OF VAPOR INTRUSION MODELING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 13 OF 15

		Site 3			Site 7		Site 15			
Chemical	EPC	Cancer	Hazard	EPC	Cancer	Hazard	EPC	Cancer	Hazard	
	(ug/L)	Risk	Index	(ug/L)	Risk	Index	(ug/L)	Risk	Index	
	Residential			Residential				Residential		
Chloroform	15	7E-06	1E-02	NA	NA	NA	3	-4E-06	7E-03	
Tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Trichloroethene - EPA Toxicity Criteria	7	3E-05%	2E-02	1	2E-06	1E-03	NA	NA	NA	
Trichloroethene - Cal EPA Toxicity Criteria	7	6E-07	1E-03	1	4E-08	8E-05	NA	NA	NA	
Vinyl Chloride	10	##8E-06	4E-02	NA	NA	NA	NA	NA	NA	
		Industrial		Industrial			Industrial			
Chloroform	15	1E-06	3E-03	NA	NA	NA	3	5E-07	1E-03	
Tetrachloroethene	NA.	NA	NA	NA	NA	NA	NA	NA	NA	
Trichloroethene - EPA Toxicity Criteria	7	: SE-06	3E-03	1	3E-07	2E-04	NA	NA	NA	
Trichloroethene - Cal EPA Toxicity Criteria	- 7	8E-08	2E-04	1	6E-09	1E-05	NA	NA	NA	
Vinyl Chloride	10	1E-06	7E-03	NA	NA	NA	NA	NA	NA	

Notes:

NA - Not a COPC at this site.

EPC = Exposure point concentration, maximum detected concentration of a chemical at a site.

Shading indicates an exceedance of USEPA and/or CTDEP acceptable risk levels.

TABLE 12 SUMMARY OF VAPOR INTRUSION MODELING RESULTS NSB-NLON, GROTON, CONNECTICUT PAGE 14 OF 15

		Site 20		•	Site 23		
Chemical	EPC	Cancer	Hazard	EPC	Cancer	Hazard	
	(ug/L)	Risk	Index	(ug/L)	Risk	Index	
		Residential			Residential		
Chloroform	NA	NA	NA	3	\$4,2E±06	5E-03	
Tetrachloroethene	NA	NA	NA	NA	NA	NA	
Trichloroethene - EPA Toxicity Criteria	5.02	4E-06	2E-03	0.5	_24E≥0j6	2E-03	
Trichloroethene - Cal EPA Toxicity Criteria	5.02	7E-08	1E-04	0.5	7E-08	1E-04	
Vinyl Chloride	NA	NA	NA	NA	NA	NA	
		Industrial			Industrial		
Chloroform	NA	NA	NA	3	3E-07	8E-04	
Tetrachloroethene	NA	NA	NA	NA	NA	NA	
Trichloroethene - EPA Toxicity Criteria	5.02	6E-07	4E-04	0.5	5E-07	4E-04	
Trichloroethene - Cal EPA Toxicity Criteria	5.02	1E-08	3E-05	0.5	1E-08	2E-05	
Vinyl Chloride	NA	NA	NA	NA	NA	NA	

Notes:

NA - Not a COPC at this site.

EPC = Exposure point concentration, maximum detected concentration of a chemical at a site.

Shading indicates an exceedance of USEPA and/or CTDEP acceptable risk levels.

TABLE 13
PRELIMINARY REMEDIATION GOALS AND OTHER ARARS FOR VAPOR INTRUSION NSB-NLON, GROTON, CONNECTICUT

Chemical	EPC ⁽¹⁾	PR	G ⁽²⁾	USEPA	CTDEP RSR ⁽⁴⁾		
Onemical	(ug/L)	Residential	Industrial	MCL ⁽³⁾	Residential	Industria	
Site 2 - Area A - Upgradient							
Chloroform	1	21	144	80 ⁽⁵⁾	26	62	
Trichloroethene ⁽⁶⁾	0.9	258	1769	5	27	67	
Site 2 - Area A - Downgradient				·	<u></u>		
Trichloroethene	2	257	1760	5	27	67	
Site 2 - Area A - Wetlands					-l		
Tetrachloroethene	1.4	18	122	5	340	810	
Trichloroethene ⁽⁶⁾	1.4	74	508	. 5	27	67	
Site 3							
Chloroform	15	21	15	80 ⁽³⁾	26	62	
Trichloroethene ⁽⁶⁾	7	12	85	28 2454 a s	27	67	
Vinyl Chloride	10	- 1 (g)	8/6	2 3 3	1.67	52	
Site 7		The second secon			as removed a service and dear definition of a latter constituting		
Trichloroethene ⁽⁶⁾	1	24	163	5	27	67	
Site 15		·				<u> </u>	
Chloroform	3	0.9	5.9	80 ⁽³⁾	26	62	
Site 20		A Committee of the Comm		- 00	<u> </u>	- 02	
Frichloroethene ⁽⁶⁾	5.02	68	467	5	27	67	
Site 23					<u> </u>	<u> </u>	
Chloroform	3	3.10.13	9.1	80 ⁽³⁾	26	62	
Trichloroethene ⁽⁶⁾	0.5	7.5	52	5	27	67	

Acronyms:

ARARs = Applicable or Relevant and Appropriate Regulations

EPC = Exposure Point Concentration.

MCL = Maximum contaminant level.

PRG = Preliminary Remediation Goal

RSR = Remediation Standard Regulations.

Notes:

All concentrations are in ug/L.

- 1 EPC is the maximum detected concentration at a site.
- 2 PRGs are based on a cancer risk of 1 x 10⁻⁶ or an hazard index of 1.
- 3 USEPA Drinking Water Standards and Health Advisories, August 2006.
- 4 Proposed Revisions Connecticut's Remediation Standard Regulations, Volatilization Criteria, March 2003.
- 5 Value is for total trihalomethanes.
- 6 PRG for trichloroethene is calculated using the Cal EPA toxicity criteria.

Shading indicates an exceedance of a PRG or ARAR.

ATTACHMENT A
BORING LOGS AND
DEPTH TO GROUNDWATER INFORMATION

(Date	, Time	& Cond	litions)					Rose	
SAMPLE MO. 8 TYPE OR ROD	OITH FUN FUN NO.	6. 04 800 800 800	CENTRAL CENTRA	(Drewn's)	SQL Dewley CONSISTENCY Of BOCK MARDWESS	COLOR	ERIAL DESCRIPTION* MATERIAL CLASSIFICATION	Sec ex vici	
M38	0.0 2.0	12 12	1.5/2.0		Druse	Bleck	Gravel w/Tr Sand	GP	Sand - M to CC-
1425	Y	15 22 61	F1\1-8	11 <u>ENE</u> 863.5	V-Oruce	Tan	Chiley Sand with Ga		said - hito (Gr.
311/54	(C)	65%	4.5/50	~~~	Hard	Gray to	Sily Sind, with Convel Greeks	BR	Grave 1 - Give 135 Mark Earl to income Council - Report
7.0	+					Dink	W/ Sand grams in the	3' 65'	SS Refutal. More
75/1.5 8.5	<u>(</u>		11/1.5		Hard	C-Gar	Chess w/saw stang	TAXA .	HIZ JANE 7.5', 7.
		4	<i>2</i>]	e Costolero je Živo je	energy and a			to 4 frac @ 12.4%
4950	(3)	70%	5.0/5.3	~	Hand	GTY.	CHESS	18r	5.6' 5.75 9 i
13.5	T					PMK			Pure His out to 13.5
						2 10 10		M.?	Hoo level @ 21
3.1/5.	<u>(D)</u>	76%	دى\4.4		Hard	Gray Durk	Cheiss	Br	15.1' 15.1' 15.2'
18.5									HIX JUT @ 15.31
				3 30			Total Depth 185	'-	Core Enrice 1 Browles 17.4"
							Jarean 85'-185"		→ 2"PVC -OiOlo Sto 4
							Sand 6'-18.5"		- 100th on sore
	\neg			ł			Pellete 3'- 6'		-SV# 800 BENT

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	No. and	(Ft.)	6° or RQD	Recovery /	Change (Depth/Ft.)	Soil Density/					S				~		.]
	Type or	Run No.	(%)	Sample Length	or Screened	Consistency	Color	Mate	rial Classi	fication	C S	Rei	narks	Sample	er B	• olo	28
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Tetra Tech NUS, Inc.

BORING LOG

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## Tetra Tech NUS, Inc.

## **BORING LOG**

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No	Semple	Depth	Blows/	Sample	Litholom	M	AIE	RIAL DESCRIPTION	1		790	FID Re	ading (	ppm)	
Co   3   5   5   5   5   5   5   5   5   5	and Type o	or Run	ROD	Recovery / Sample	Change (Depth/FL) or Screened	Consistency or Rock	Colo	Material Classification	S C	Remarks	Sample	ampier 82	orehole**	riller BZ**	
20 66  5.2 470%  4.0 63  14.0 63  15.0 4 120  15.1 4 120  15.1 4 1020  15.1 4 1020  15.1 4 1020  15.1 4 1020  15.1 4 1020  15.1 4 1020  15.1 4 1020  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 5.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  15.1 4 1030  16.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.1 1030  17.	-	0.0		0.9/						Time		e e		a a	
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Myshit from Creanic Clayer OH (030) 123 0.0 1.3  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si Lt  Si		10.0		2 50 -			,	Silt							
Soft of Organic Clayes OU 10to H25 over 3350  To Root & Remark Drive 4 temp Cosins  No. Stell clay Over Clayer OU 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2  Silt Over 1000 H25 over 984000 0-2	54	· .	<del>2/</del>	4.0		MSfiff	500	<del></del>	OH	(03()	123	0.0		1	
Tr Roots (Remnant) Orine 4" fem Cosing  No SHER Com Original Clayer OU 1100 Hz Sodor 99.400 0-2  Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt of Silt		80	<u> </u>	100				Si U						L	
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Sith Sith Sith Sith Sith Sith Sith Sith		(0.0	$ZV_{\mu}$					Tr Roots ( remnant		Drive 4"temp Cosin					
Myhild olim Organic Clargey of 1125 1246.2 02  Soft   1/30 1320.2 0.2  Soft   1/30 1320.2 0.2  Soft   1/30 1320.2 0.2  Soft   1/30 1320.2 0.2  Soft   1/30 1320.2 0.2  Soft   1/30 1320.2 0.2  Typic Casing to 15'  Restante 2-3  Protestive Casing 2.5' Strong  Protestive Casing 2.5' Strong  When rock coring, enter rock brokeness.  Include monitor reading in 6 tool intervals @ borehole. Increase reading trequency if elevated reponse read.  Remarks: 1'55  **Sample 2w-Su-4605-64-55	5-6			2.0		No SHEF	dw w	Organic Clayer	ou			oro		0-0	
When rock coring, enter rock brokeness.  When rock coring, enter rock brokeness.  Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:  Sample 2n-5u-46D5-64-55    1/30   1320.3   0.0     4"Teng Carsing   1320.3   0.0     4"Teng Carsing   1320.3   0.0     4"Teng Carsing   151   151     4 Valve #v Sand 3'-15'     4 Restants 2-3   2.5' Strung   1240 2010     5 Strung   1240 2010   1240 2010     5 Drilling Area Background (ppm): 0.0		120	/ 7					S: It 0							
SE 53230  Soft   1/30   132000 0.00    God   1/30   132000 0.00    There casing to 15'   Valve #0 Sand 3'-15'   Restante 2-3   Protective Casing 2.5' Strength    When rock coring, enter rock brokeness.   Include monitor reading in 6 tool intervals @ borehole. Increase reading frequency it elevated reponse read.   Remarks:   1/55   Protective 2 w- Su - 46 DS- & 4-85			43	730		mstiff	9W		014	1125	124	<b>6.</b> 3		03	
When rock coring, enter rock brokeness.  "Include monitor reading in 6 tool intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks: ) (55  **Sample 2 - 5u - 46 D5 - 64 - 55	<del></del>	t	1					Sift Tr-shell							
They Casing  2"pu (G-Slot 4-14'  Valve #v Sand 3'-15'  Bestante 2-3  Protective Casing 2.5' Strely  Protective Casing 2.5' Strely  1240 Dends  Drilling Area  Background (ppm): 0.3.				420		2014				1130	132	۵.۶		0.0	
*When rock coring, enter rock brokeness.  *Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  *Remarks: 3'55  **Sample 2w-5u-46D5-64-55  **Background (ppm): 0.3.		6.0					1	V	4						
"When rock coring, enter rock brokeness. "Include monitor reading in 6 boot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:  1 55  Sample 2w-5u-46 D5-64-55  Prof. of 4-14'  Valve #v 5ad 3'-15'  Review 5ad 3'-15'  Review 5ad 3'-15'  Buttonute 2-3  Prof. of Strong  Drilling Area  Background (ppm): 0.0.												-			
When rock coring, enter rock brokeness.  "Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:   "SS  ** Sample 2 w- Su - 46 DS - & 4 - 55  ** Sample 2 w- Su - 46 DS - & 4 - 55							-			to 151					
When rock coring, enter rock brokeness.  "Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:   "SS  ** Sample 2 w- Su - 46 DS - & 4 - 55  ** Sample 2 w- Su - 46 DS - & 4 - 55					]					·					
Protective Curry 2.5' Strely  *When rock coring, enter rock brokeness.  *Include monitor reading in 6 foot intervals & borehole. Increase reading frequency if elevated reponse read.  *Remarks:   **Sample 2w-Su-46DS-84-99  **Background (ppm): 0.3.		_			}										
Protective Custing 2.5 (Strely)  *When rock coring, enter rock brokeness.  *Include monitor reading in 6 foot intervals & borehole. Increase reading frequency if elevated reponse read.  Remarks:   **Sample 2w-Su-46DS-64-99  Background (ppm): 0.3.					ļ	-		. Α		15					
*When rock coring, enter rock brokeness.  "Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:   **Sample 2 w - Su - 46 DS - 64 - 55  **Sample 2 w - Su - 46 DS - 64 - 55		-+													
*When rock coring, enter rock brokeness.  "Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:   **Sample 2 w - Su - 46 DS - & 4 - SS  Background (ppm): 0.0.					1		$\Box$	Protective ass	in	2.5 Strehy	p				
*When rock coring, enter rock brokeness.  "Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:   **Sample 2 w - Su - 46 DS - & 4 - SS  Background (ppm): 0.0.		_			I				<u></u>	U					
"Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.  Remarks:     1   5	14/2	(OC)	ing acti	tock been						1240 Dends					
Remarks: 3" 55  # Sample 2 w - 5u - 46 D5 - 64 - 99 4 - 99  Background (ppm): 0.3	** Includ	e monit	or reading	in 6 foot		borehole, inc	crease	reading frequency if elevated reponse r	read.	Drill	ina A	vea.			
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Converted to Well: Yes / No Woll D #: 16:11 44 (1// 5 =		- - : :			<u> </u>	- 2 w -									

Converted to Well:

Yes

No

Well I.D. #:

3MW 751

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		NAM		NSI	3 New L	ondo	n, CT Site 3	BORING N	lo.:		3MW1	51			
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			PANY:				g Contractors	_GEOLOGI:	ST:		Colin Do				
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Tetra Tech NUS, Inc.
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Page 2 of 3

	PRC	JECT	F NAMI F NUM G COM	BER:	CTO 038, G00083 DATE: 4/19/06								N16D - 4/28/06				
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	No. and Type o ROD	Depth (Ft.) or Run No.	Blows / 6" or ROD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	Soil Density Consistency or Rock Hardness		RIAL DESCRIP		U S C S .	Remarks	Sample Sample			Driller BZ**		
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Page <u>3</u> of <u>3</u>

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			T NUM			CTO	038, 0	G00083	DATE:		3MW16D 4/19/06 - 4/26/00 Colin Doolan					
			G COM	PANY:	New	England	l Borir	ng Contractors	_GEOLOGI	ST:						
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	<u> </u>	T	7 mg.	,	=	17	<u>obile</u>			DRILLER:		S. Ramsdell					
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TE	Tetra Tech NUS, Inc.
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Page 2 of 2

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## BORING LOG 2D MW 16S

PROJECT: IR STUDY NSB - NLON PROJECT NO: 1256-10 _DCATION: AREA A DOWNSTREAM DATE STARTED: 09/18/90 DATA COMPLETED: 09/19/90 DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC. DRILLER: JOE RAAB DRILLING METHOD: HOLLOW STEM AUGER SAMPLING METHOD: SPLIT SPOON

GROUND ELEVATION: 35.6 PROTECTIVE CASING ELEVATION: 38.08 WELL ELEVATION: 37.85 WATER LEVEL: 34.30 (03/21/91) DATUM: SUBASE WEATHER: 60°, CLEAR SKIES, VERY WINDY INSPECTOR: LYNN METCALF AND ERIK NESS CHECKED BY: ERIK NESS

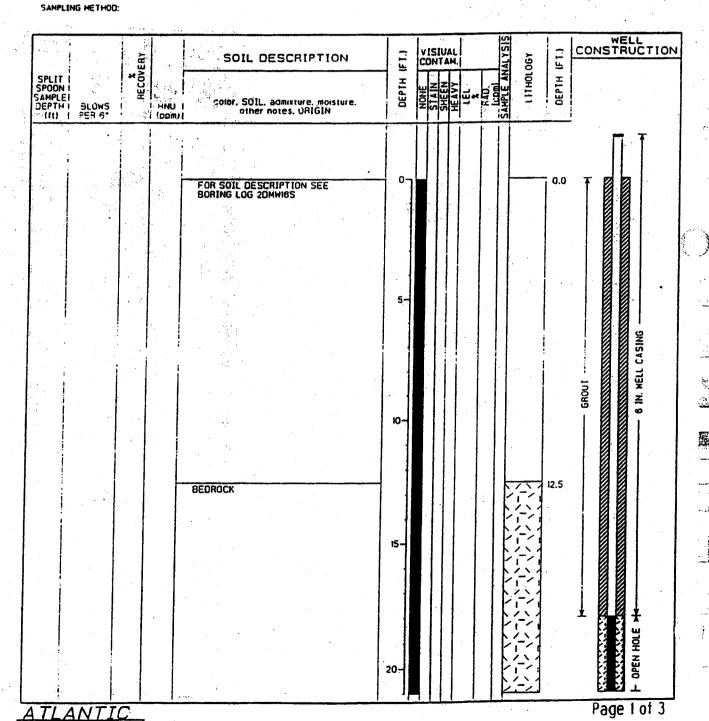
WELL CONSTRUCTION (FT.) RECOVERY SOIL DESCRIPTION LITHOLOGY CONTAM. SPLIT SPOON I SAMPLE DEPTH DEPTH color, SOIL, admixture, moisture, other notes, ORIGIN HNU (pom) BLOWS PER 6° (11) 0.0 0-Dark brown, fine SAND and SILT. trace roots, moist, TOP SOIL 5 7 00 0.2 0 40 50 0-2 Brown, medium to coarse SAND and 0 GRAVEL, trace silt, moist BENTONITE -69 0 50 30 0.4 2-4 10 11 00 100/5 5-0 50 5 0.2 4-8 0.0 SLOTTED PVC 6.0 Grey, fine to very fine SAND and SILT, wet 26 30 50 50 0.2 6-8 13 7 8.0 Brown, tine to medium SAND and GRAVEL, trace sit, wet 00 6 20 o o 40 8-10 60 0.2 31 45 00 0 10 00 42 100 1 50 10-12 0.2 100/5 00 0 00 100/5 40 12-14 100 0.2 Ю 13.5 AUGER REFUSAL AT 13.5 feet 20 TLANTIC

Page 1 of 1

### BORING LOG 2D MW 16D

PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1256-10
LOCATION: AREA A DOWNSTREAM
CATE STARTED: 09/13/90
DATA COMPLETED: 09/18/90
DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
DRILLING METHOD: AIR ROTARY

DROUND ELEVATION: 35.9
PROTECTIVE CASING ELEVATION: 37.69
MELL ELEVATION: 37.69
MATER LEVEL: 3.74 (03/21/91)
DATUM: SUBASE
MEATHER: 50-60', CLEAR SKIES
INSPECTOR: AKHTER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS



## BORING LOG 2D MW 16D

PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1256-10
LOCATION: AREA A DOMNSTREAM
DATE STARTED: 09/13/90
DATA COMPLETED: 09/18/90
ORILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
ORILLER: CRAIG CONNER
ORILLING METHOD: AIR ROTARY
SAMPLING METHOD:

GROUND ELEVATION: 35.9
PROTECTIVE CASING ELEVATION: 37.69
WELL ELEVATION: 37.69
WATER LEVEL: 3.74 (03/21/91)
DATUM: SUBASE
WEATHER: 50-60°, CLEAR SKIES
INSPECTOR: AKMTER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS

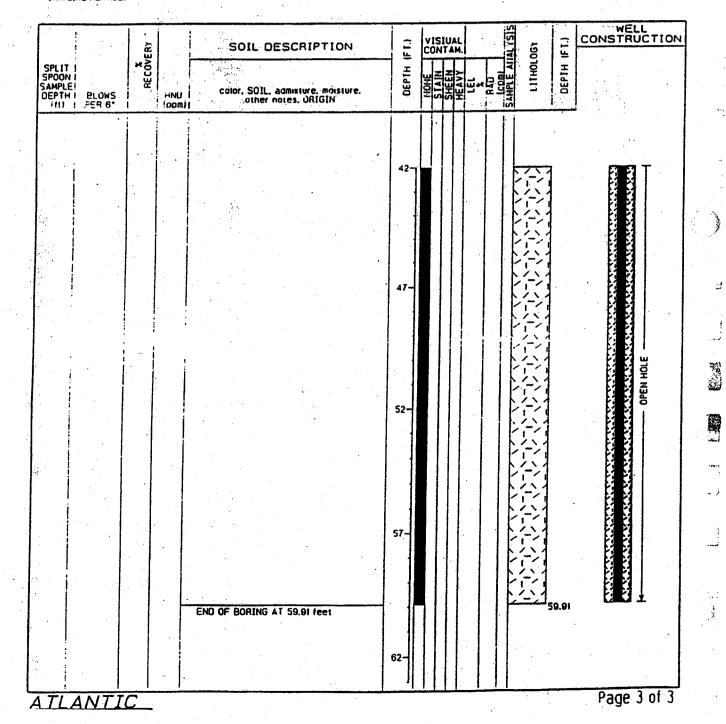
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			KER		SOIL DESCRIPTION	E	CONTAM		907	<u>.</u>
	SPLIT SPOON SAMPLE DEPTH (11)	BLOWS	RECOVERY	HNU (ppm)	color, SOIL, admixture, moisture, other notes, ORIGIN	ОЕРТН	SHEEN HFAVY	RAD. (CDB)	L11H0L0GY	H 1
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						41-				L KANAN
L	ATL	ANTI	C							Page 2 of 3

### BORING LOG 2D MW 16D

PROJECT: IR STUDY NS8 - NLON 990JECT NO: 1256-10 LOCATION: AREA A DOWNSTREAM DATE STARTED: 09/13/90 DATA COMPLETED: 09/18/90 DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC. DRILLER: CRAIG CONNER PRILLING METHOD: AIR ROTARY SAMPLING METHOD:

GROUND ELEVATION: 35.9 PROTECTIVE CASING ELEVATION: 37.69 WELL ELEVATION: 37.69 MATER LEVEL: 3.74 (03/21/91) DATUM: SUBASE WEATHER: 50-60", CLEAR SKIES INSPECTOR: AKHTER HOSSAIN AND LYNN HETCALF

CHECKED BY: ERIK NESS



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PROJ	ECT: _	) ·	8- NL	<u> </u>			BORING	NO.	- 7'MW55
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		arows.	SAMPLE		ļ	MA	TERIAL DESCRIPTION*	100	
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	4'	Soir	cusin	^4					

ATE	R LEV	EL DAT	A:			·	OLOGIST: James R. FERGUSON  RAIH 45° 3-16-93 CLEI		
7 K.O	oemi eu ex Run No.	8LOWS 67 OR 800 (%)	ENMALH STWOFF PECONESA STWOFF	LiftedLOGV Change Change Change	SOIL DEWSITY CONSISTENCY OR ROCK HARDMESS		TERIAL DESCRIPTION*  MATERIAL CLASSIFICATION	Place BAR GAR VIICS	
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BC	RING	LOG							ILLIBURTON NUS
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VATI Date	:R·LEV	& Cond	itions)	3-19-9	5 Out	RIPST	Rain 450 3-16-9	55 CLEAR	450
			T				ERIAL DESCRIPTION*	Roci	_ <del></del>
AMPLE NG TYPE OR RQD	DEFTN ITLI OK RUN NO.	BLÖWS 6" OR RGO ("S)	SAMPLE RECOVERY SAMPLE LENGTH	CHANGE (Deem.ft.)	SOL DENSITY CONSISTENCY HARDNESS		MATERIAL CLASSIFICATION	or or or or or or or or or or or or or o	
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Page 1 of 2

		F NAM		NS	B New L	ondo	n, CT Site 7 00083	_BORING N DATE:	o.:	7MW1				
			PANY:	New	England	Borin	g Contractors	_DATE: GEOLOGI	эт. Т	5/17./				
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				T				<u></u>	,	S. Rams.	<u>del</u>	<u>r</u>		
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Conve	erted 1	lo Well	: `	Yes	X		No	Well I D	#.	7141417				

Page 2 of 2

PRO	JEC.	T NAM T NUM	BER:		B New L	_ondo	on, CT Site 7 300083	BORING	No.:	7MV		_	
			PANY:	New	/ England	Bori	ng Contractors	DATE: GEOLOG	ICT.	5/17	10.6		
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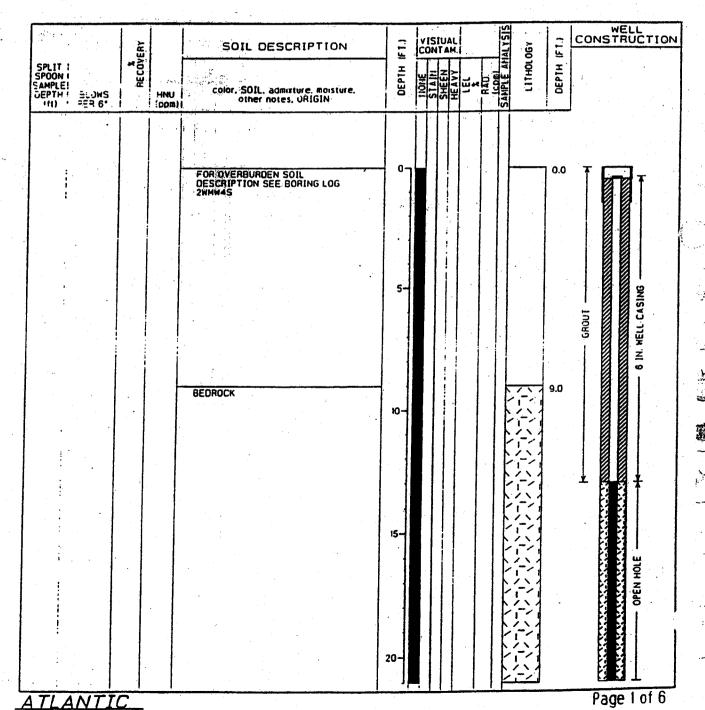
Page ___ of __

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			58-N	· · ·				BORING	NO.:	AWLMW25
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PROJECT: !P STUDY NSB - M.ON
PROJECT NO: 1258-10
LOCATION: AREA A METLAND
DATE STARTED: 09/19/80
OATA COMPLETED: 09/19/790
ORILLING CONTRACTOR: EMPIRE-SOILS INVESTIGATIONS, INC.
ORILLER: CRAIG CONNER
CRILLING METHOD: AIR ROTARY
SAMPLING METHOD:

GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
WELL ELEVATION: 92.69
WATER LEVEL: 7.43 103/21/911
DATUM: SUBASE
WEATHER: 65'. CLEAR. SUNNY
INSPECTOR: AKMTER HOSSAIN AND LYNN METCALF
CHECKED 8Y: ERIK NESS



PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1256-10
LICATION: AREA A METLAND
DATE STARTED: 09/19/90
DATA COMPLETED: 09/27/90
CRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
CRILLING METHOD: AIR ROTARY
LAMPLING METHOD:

GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
MATER LEVEL: 7.43 (03/21/91)
DATUM: SUBASE
MEATHER: 65'. CLEAR SUNNY
INSPECTOR: ARHTER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS

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PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1258-10
LOCATION: AREA A METLAND
DATE STARTED: 09/19/80
DATA COMPLETED: 09/27/90
DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
ORILLER: CRAIG CONNER
DRILLING METHOD: AIR ROTARY
SAMPLING METHOD:

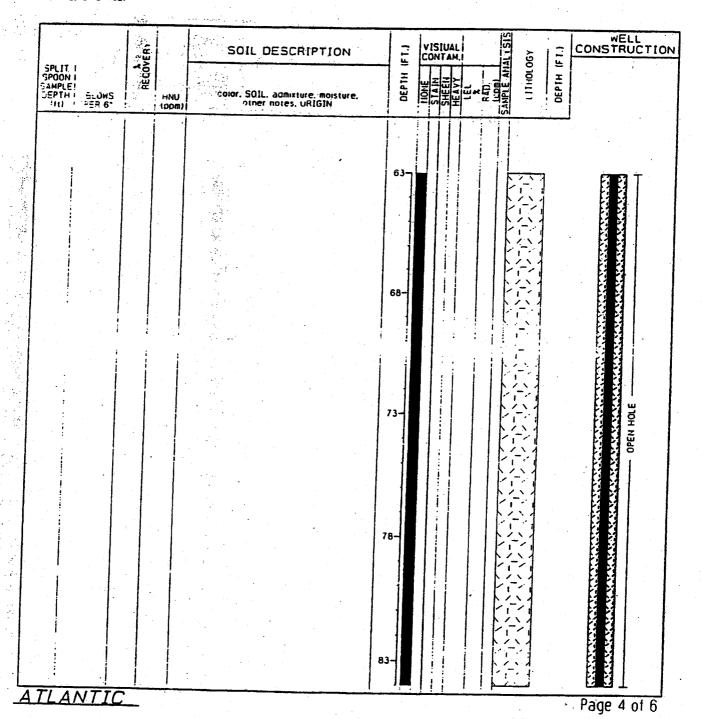
GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
WELL ELEVATION: 92.69
WATER LEVEL: 7.43 (03/21/91)
DATUM: SUBASE
WEATHER: 65°. CLEAR SUNNY
INSPECTOR: AKHTER HOSSAIN AND LYNN METCALF

INSPECTOR: AKHTER HOSSAIN AND LYNN NETCALI CHECKED BY: ERIK NESS

WELL CONSTRUCTION VISIUAL RECOVERY (F1.) (FT.) SOIL DESCRIPTION LITHOLOGY SPLIT I SPOON I SAMPLEI DEPTH I color, SOIL, admixture, moisture, other notes, URIGIN EER 6 HNRI (moo! 42-62 Page 3 of 6

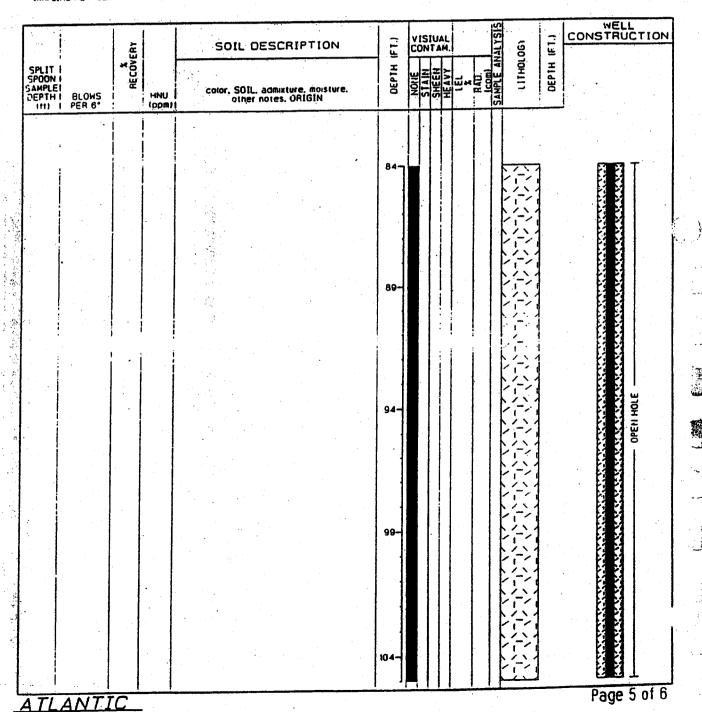
PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1256-10
LOCATION AREA A WETLAND
DATE STARTED: 09/19/90
DATA COMPLETED: 09/27/80
DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
DRILLING METHOD: AIR ROTARY
SAMPLING METHOD:

GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
WELL ELEVATION: 92.69
WATER LEVEL: 7.43 (03/21/91)
DATUM: SUBASE
MEATHER: .85°. CLEAR. SUNNY
://SPECTOR: AKM TER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS



PROJECT: IR STUDY NSB - NLON
PROJECT NO: 1256-10
L'ICATION: AREA A WETLAND
DATE STARTED: 09/19/80
DATA COMPLETED: 09/27/90
DRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
DRILLER: CRAIG CONNER
DRILLING METHOD: AIR ROTARY
SAMPLING METHOD:

GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
WELL ELEVATION: 92.69
WATER LEVEL: 7.43 (03/21/91)
DATUN: SUBASE
WEATHER: 65°, CLEAR, SUNNY
THISPECTOR: AKHTER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS



FROJECT: IR STUDY NSB - NLON
FROJECT NO: 1256-10

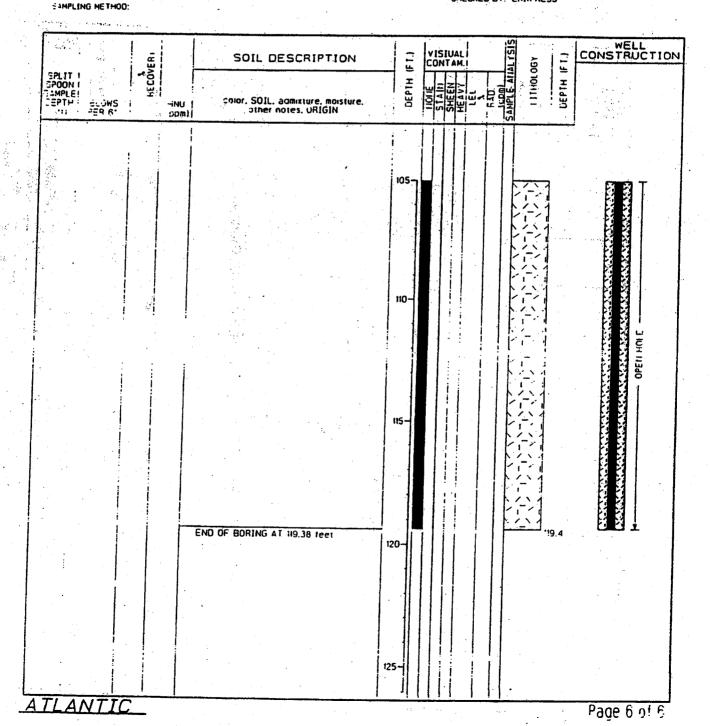
JICATION: AREA A WETLAND
DATE STARTED: 09/19/90

CATA COMPLETED: 09/27/90

TRILLING CONTRACTOR: EMPIRE SOILS INVESTIGATIONS. INC
ESTILLER: CRAIG CONNER

GRILLING METHOD: AIR ROTARY

GROUND ELEVATION: 93.07
PROTECTIVE CASING ELEVATION: 92.69
WELL ELEVATION: 92.69
WATER LEVEL: 7 43 (03/21/91)
DATUM: SUBASE
WEATHER: 65'. CLEAR SUNNY
INSPECTOR: AKHTER HOSSAIN AND LYNN METCALF
CHECKED BY: ERIK NESS





Page ___ of ___

			E: NS				1 4	-6-	17	BORING NUMBER:		NUS 23	<del></del> ;
DRILL	ING C	OMF	ANY: DATA:	SOIC			7.1	אכ	_	GEOLOGIST: STA		CONT	
F		<u> </u>		Γ					ΛA	TERIAL DESCRIPTION	T		
Sample No. and Type or RGD	Depth (FL) or Run No.	Blows/ 6° or RQD (%)	Sample Recovery/ Sample Langth	Litholog Chang (Depthif or Screen Interve	"L1	Sell D. Commel Reak 16	ency o	Co	ior	, Meterial Classification	USCS	Remarks	FIO or PID Reading (ppm)
S-1	0.0	5/	1.8/20			MD	æ	Bei	y_	SILTY SAND - TR ROOTS/	ΞM	MOIST	%
1350		13/3						_	<u> </u>	1 ROCK FRAG.			
5-2		9/0	1.7/2.0			MDE	NSE		į L	SILTY SAND - SOME ROCK	5m	MOIST	0/2
1352	4.0	8/3 13							Ļ	FRAG			
S-3		8/6	1.5/2.0			MŒ	Œ			FINE TO MED SAND	M	DAMP + MOIST	19/4
1405	6.0	1/5			ı	ا		٦			Sp		
5-4		1/2	1-3/2.0	ד	_	MDE	RE	IAT 490	K N	SUTY F. MED SAND	SM	MOIST	%2
1407	8.0	3/8			Н		<u> </u>		,_		Sp		
5-5	•	9/8	1.5/2.0	9.0	Ц			GRI	ΔĽ	<b>\</b>		MOIST > WET	9/4
1415	10.0	2		HIT HZO		١	7	4	2-1-	SILTY F SAND	SM	E 9'WET SENT \	
5-6		36	1.6%	≈9	, ,	MÆ	ME	Bei	3	4		SW50.23-08	
1418	12.0	100			N			GRA	Ψ.	SILTY VF SAND	SM	wer	Ŏ
					U							ALMOST SAUDY STUT	
	120					7	1	V	7	+			
ร-า		45	1-8/2.0			MDE	Œ	TAV BSZ		SILTY F SAND- SANDY	SM	WET	%2
1430	17.0	8		17.0	Ц	Ì	7			SICT	ML		
				-							<u> </u>	w/ layering	
		$\angle$											
										TI OT AZH			
										SPOONS 7			
				·			-	·		SCREEN 7-17			
										SAND 5-17		•	
										PELLETS 3-5			
										FLUSH MT (GROUT TO S	บย	)	
*When r	ock co	ring er	iter rock	broken	ess	5.							
CONVE				: <u> </u>	Ýε	es	_ No	;		WELL I.D.#: HNUS	-2	3	
- /_inn /i			SFX	UP		1340	<u> </u>	JR.	٤.	9.	L	B (SWLOK)	·
Signatu	.co/c\.		<del></del>	· —	<u> </u>	<del>. ;</del>							<u> </u>

GROUNDWATER ELEVATIONS - ROUNDS 9 THROUGH 11
YEAR 3 GROUNDWATER MONITORING REPORT FOR AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

TABLE 4-4

		Rou	ind 9	Rou	nd 10	Rot	ınd 11
WELL	Reference Elevation ⁽²⁾	Decer	nber-01	Mar	ch-02		mber-02
ID	(feet)	Depth to	Groundwater	Depth to	Groundwater	Depth to	Groundwater
		Water	Elevation ⁽²⁾ (feet)	Water	Elevation ⁽²⁾ (feet)	Water	Elevation ⁽²⁾ (feet)
4MW1S	129.55	9.9 🕊	119.65	6.29 ⊁	123.26	8.15	121.40
2LMW20S	86.83	18.02	68.81	15.81	71.02	16.53	70.30
2WMW21S	76.31	4.98	71.33	4.33	71,98	4.77	71.54
3MW37S	47.26	3.79 卷	43.47	3.61*	43.65	3.65	43.61
3MW12D ⁽¹⁾	47.22			••		4.44 ⁽³⁾	42.78
2WMW38DS	74.06	7.61	66.45	5.81	68.25	7.93	66.13
2WMW39DS	73.53	3.4 *	70.13	2.40 🛠	71.13	3.31	70,22
2WMW40DS	73.21	3.81	69.40	3.15	70.06	3.79	69.42
2WMW41DS	73.39	3.24	70.15	2.42	70.97	2.89	70.50
2WMW42DS	73.65	2.5	71.15	2.05	71.60	2.64	71.01
2WMW43DS	74.36	3.28	71.08	2.44	71.92	2.90	71.46
2WMW44DS	73.72	2.29	71.43	1.62	72.10	2.00	71.72
2WMW45DS	74.24	2.95	71.29	2.12	72.12	2.60	71.72
2WMW46DS	73.53	2.28	71.25	1.55 🗶	71.98	1.97	71.56
2WMW47DS	73.39	2.37	71.02	1.38	72.01	1.75	
2LMW29A ⁽¹⁾	91.37				72.01	8.91	71.64
2LMW29F ⁽¹⁾	91.50					10.56	82.46
2LMW7S ⁽¹⁾	84.87					11.85	80.94
2LMW7D ⁽¹⁾	85.74					6.65	73.02
2LMW32F ⁽¹⁾	84.52						79.09
2LMW32DS ⁽¹⁾	84.17					13.18	71.34
2LMW32B ⁽¹⁾	84.81					12.57 12.21	71.60 72.60

¹ No water levels were taken in these wells during Rounds 9 and 10.

² Elevations based on Base 1982 Vertical Datum.

³ Water level measured in December 2002.

TABLE 3-1

# MONITORING WELL CONSTRUCTION AND ROUND 4 WATER LEVEL INFORMATION YEAR 1 ANNUAL GROUNDWATER MONITORING REPORT FOR SITES 3 AND 7 .NSB-NLON, GROTON, CONNECTICUT

Monitoring Well	Northing (1)	Easting (1)	Ground Surface Élev (ft) (2)			Screened Aquifer		Screen Bottom	Screen Top	Screen Bottom	Depth to	Groundwater
Site 3			EIBV (II)	Elev (ft) (2)	Elev (ft) (2)		Depth (ft)	Depth (ft)	Elev (ft) (2)	Elev (ft) (2)	Water (ft) ⁽³⁾	Elevation (ft) ⁽³⁾
2DMW16S	708522.1	1181411.1	33.21	35.69	35.46	Constitution (All 1997)						
2DMW16D	708531.9	1181404.8	33.51			Overburden (Alluvium)	1.69	11.69	31.52	21.52	3.87	31.59
2DMW25S	708649.4			35.30	NA NA	Bedrock	18.00	59.91	15.51	-26.40	3.72	31.58
		1180952.5	31,09	33.02	32.59	Overburden (Fill)	5.50	10.50°	25.59	20.59	6.80	25.79
2DMW28D	708835.6	1180594.4	33.22	33.22	33.01	Bedrock	26.00	136.00	7.22	-102.78	16.11	16.90
2DMW29S	709579.0	1181082.1	32.59	34.47	34.29	Overburden (Alluvium)	6.00	16.00	26.59	16.59	8,57	25.72
3MW15S	709329.6	1180638.3	33.20	33.24	32.86	Overburden (Alluvium)	28.00	38.00	5.20	-4.80	29.38	3.48
3MW151	709351.2	1180640.8	33.50	33.53	33.10	Overburden (Alluvium)	55.50	65.50	-22.00	-32.00	30.85	2.25
3MW16S	709908.8	1180730.0	36.10	36.10	35.78	Bedrock	17.00	27.00	19.10	9.10	14.36	21,42
3MW16D	709899.8	1180723.2	36.20	36.19	35.80	Bedrock	59.00	69.00	-22.80	-32.80		
Site 7						Boarden	1 00.00	03.00 1	-22.00	*32.60	22,12 🔆	13.68
7MW1D	709291.1	1182145.8	52.28	NA NA	51.69	Bedrock	14.20	25.20	38.08	27.08	8.98	42.71
7MW3S	709033.9	1181704.2	43.59	43.59	43.32	Overburden (Fill/Alluvium)	6.90	16,90	36.69	26.69	5.60	37.72
7MW3I	709021.9	1181707.0	43.40	45.38	45.21	Overburden (Alluvium)	22.50	32.50	20.90	10.90	7.35	37.86
7MW5D	709280.3	1181887.3	54.43	54.43	54,18	Bedrock	32.00	42.00	22.43	12.43	12.40*	41.78
7MW9S	709177.8	1181377.0	35.80	35,77	35,40	Overburden (Alluvium)	4.00	14.00	31.81	21.81		
7MW12S	709075.9	1181805.7	44.10	44.13	43.62	Overburden (Fill/Alluvium)	3.50				3.86	31.54
7MW12!	709070.3	1181808.8	44.20	44.22	43.90			13.50	40.60	30.60	3.26	40.36
7MW13S	708891.7	1181882.7				Overbürden (Alluvium)	20.00	30.00	24.20	14,20	4.97	38.93
/ 11111 100 1	700091.7	1101002./	48.60	50.79	50.58	Overburden (Fill/Alluvium)	6.50	16.50	42.10	32.10	8.91	41,67

¹ North American Datum (NAD) 83, Connecticut State Plane Coordinate System

² North American Vertical Datum (NAVD) 88 (NAVD 88 = 1982 Base Vertical Datum - 2.39 feet (3)). Vertical datum conversion factor of 2.39 feet was provided by NSB-NLON Public Works Department. 3 Water levels were measured on March 17th and 18th, 2007.

NA - Not available

Elev - Elevation

ft - Feet

#### TABLE 2-2

# WATER LEVEL MEASUREMENTS AND ELEVATIONS OCTOBER 2002 DGI BASEWIDE GROUNDWATER OU RI UPDATE/FS NSB-NLON, GROTON, CONNECTICUT

Well Name	Depth to Top of Monitored Interval (feet bgs)	Depth to Bottom of Monitored Interval (feet bgs)	Reference Point Elevation ⁽¹⁾ (feet)	Reference Point Elevation ⁽²⁾ (feet)	Well Diameter (inches)	Aquiter Monitored	October 2002 Depth to Water (feet)	October 2002 Water Elevation ⁽²⁾ (feet)
SITES 3/14							1,100.7	
2DMW10D	10.00	26.09	54.52	52.13	6	BEDROCK	10.13	42.00
2DMW11D	19.50	25.50	53.20	50.81	6	BEDROCK	NM ⁽³⁾	NA.
2DMW11S	2.50	12.50	46.85	44.46	2	OVERBURDEN (ALLUVIUM)	2.09	42.37
2DMW15D	10.00	19.51	44.09	41.70	6	BEDROCK	7.32	34.38
2DMW16D	18.00	59.91	37.69	35.30	6	BEDROCK	5.28	30.02
2DMW16S	1.69	11.69	37.85	35.46	2	OVERBURDEN (ALLUVIUM)	5.85	29.61
2DMW23D	7.50	65.00	83.38	80.99	6	BEDROCK	30.41	50.58
2DMW24D	25.00	45.00	36.07	33.68	6	BEDROCK	4.65	29.03
2DMW24S	4.00	14.00	36.29	33.90	2	OVERBURDEN (ALLUVIUM)	NM ⁽⁴⁾	NA NA
2DMW25D	18.00	40.00	35.48	33.09	6	BEDROCK	8.48	24.61
2DMW25S	5.50	10.50	34.98	32.59	2	OVERBURDEN (FILL)	8.12	24.47
2DMW26D	30.00	40.00	29.19	26.80	2	OVERBURDEN (ALLUVIUM))	10.51	16.29
2DMW26S	8.00	18.00	28.71	26.32	2	OVERBURDEN (ALLUVIUM)	6.63	19.69
2DMW27D	20.00	205.00	27.95	25.56	6	BEDROCK	12.96	12.60
2DMW28D	26.00	136.00	35.40	33.01	6	BEDROCK	16.95	16.06
2DMW28S	17.00	22.00	35.26	32.87	2	OVERBURDEN (ALLUVIUM)	18.23	14.64
2DMW29S	6.00	16.00	36.68	34.29	2 ,	OVERBURDEN (ALLUVIUM)	9.11	25.18
2DMW30S	4.00	9.00	33.11	30.72	2	OVERBURDEN (ALLUVIUM)	7.35	23.37
3MW12D	20.00	25.00	47.22	44.83	2	BEDROCK	4.44	40.39 ⁽⁵⁾
3MW14S	28.00	38.00	36.81	34.42	2	OVERBURDEN (ALLUVIUM)	32.16	2.26
14MW1S	4.00	14.00	51.54	49.05	2	OVERBURDEN (ALLUVIUM)	5.01	44.04
3TW27	1.00	6.00	38.20	35.81	<del>- i - </del>	OVERBURDEN (ALLUVIUM)	5.86	29.95
3TW28	1.70	6.70	39.56	37.17	1.	OVERBURDEN (ALLUVIUM)	7.12	30.05
3TW29	3.00	7.50	38.96	36.57	1	OVERBURDEN (ALLUVIUM)	8.78	27.79
3TW30	6.00	16.00	37.81	35.42	1	OVERBURDEN (ALLUVIUM)	8.13	27.29
SITE 7							0.10	27.23
7MW10S	4.00	14.00	43.42	41.03	2	OVERBURDEN (ALLUVIUM)	12.25	28.78
7MW3D	23.80	33.80	46.67	44.28	2	OVERBURDEN (ALLUVIUM)	8.90	35.38
SITE 20					,			
2WCMW1S	8.00	18.00	83.92	81.53	2	OVERBURDEN (FILL/DREDGE)	12,10	69.43
2WCMW2S	4.00	14.00	86.16	83.77	2	OVERBURDEN (FILL)	4.57	79.20
2WCMW3S	5.75	15.75	85.95	83.56	2	OVERBURDEN (FILL/DREDGE)	10.03	73.53
2WMW4D	13.00	119.40	92.69	90:30	6	BEDROCK	6.14	84.16
SITE 15								
15MW1D	36.00	46.00	28.05	25.66	2	OVERBURDEN (ALLUVIUM)	10.24	15.42
15MW1S	5.00	15.00	28.08	25.69	2	OVERBURDEN (ALLUVIUM)	7.02	18.67
15MW2S	5.00	15.00	28.90	26.51	2	OVERBURDEN (ALLUVIUM)	7.82	18.69
15MW3S	5.00	15.00	26.26	23.87	2	OVERBURDEN (ALLUVIUM)	5.81	18.06
15TW01	5.00	15.00	29.62	27.23	1	OVERBURDEN (ALLUVIUM)	8.45	18.78
15TW02	5.00	15.00	29.09	26.70	1	OVERBURDEN (ALLUVIUM)	7.98	18.72
15TW03	5.00	15.00	27.52	25.13	1	OVERBURDEN (ALLUVIUM)	6.49	18.64

#### Notes

- 1 Elevation based on Base 1982 Vertical Datum.
- 2 Elevation based on NAVD 1988.
- 3 A water level measurement could not be taken at monitoring well 2DMW24S because it could not be located. It was assumed to have been destroyed.
- 4 A water level measurement could not be taken at monitoring well 2DMW11D because it was destroyed.
- 5 Measured on 12/04/02.

bgs = Below ground surface.

NA = Not applicable.

NM = No Measurement,

### TABLE 2-2

#### WATER TABLE ELEVATION SUMMARY - JUNE 2000 BASEWIDE GROUNDWATER OU RI NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

Well Name	Depth to Top of Screen (Feet)	Depth to Bottom of Screen (Feet)	Top of Casing Elevation 1982 Datum	Top of Casing Elevation 1988 Datum	Well Diameter	Aquifer Monitored	Depth to Water (feet) June 2000	Water Elevation (ft-ms!)* June 2000
7MW4S	4.00	14.00	46.84	44.45	2	BEDROCK	2.08	42.37
7MW50	32.00	42.00	56.57	54.18	2	BEDROCK	11.84	42.34
7MW5S	7.00	17.00	56.62	54.23	2	OVERBURDEN (ALLUVIUM)/ BEDROCK	11.9	42.33
7MW6S	4.00	14.00	46.65	44.26	2	OVERBURDEN (ALLUVIUM)	3.97	40.29
7MW7S	5.50	15.50	46.57	44.18	2	BEDROCK	1,87	42.31
7MW8S	3.00	13.00	42.10	39.71	2	OVERBURDEN (ALLUVIUM)	3.81	35.90
7MW9S	4.00	14.00	37.91	35.52	2	OVERBURDEN (ALLUVIUM)	4.48	31.04
B325-MW1	3.00	13.00	47.23	44.84	2	OVERBURDEN/BEDROCK	2.53	42.31
B325-MW3	2.50	12.50	46.05	43.66	2	OVERBURDEN	1.24	42.42
B325-MW4	4.00	14.00	46.88	44.49	2	OVERBURDEN	3.42	41.07
SOUTHERN R							7	
8MW1	6.40	16.40	10.15	7.76	2	OVERBURDEN (FILL)	8.37	-0.61
8MW2D	54.00	64.00	9.77	7.38	2	OVERBURDEN (ALLUVIUM)	7.18	0.20
8MW2S	5.90	15.90	9.43	7.04	2	OVERBURDEN (FILL)	6.52	0.52
8MW3	5.80	15.80	8.96	6.57	2	OVERBURDEN (FILL)	6.09	0.48
8MW4	5.40	14.40	9.34	6.95	2	OVERBURDEN (FILL)	6.14	0.81
8MW5S 8MW6D	60.00	16.00 70.00	10.94	8.55 7.23	2	OVERBURDEN (FILL)	9.03	-0.48
8MW6S	4.00	14.00	9.62 9.66	7.23	2	OVERBURDEN (ALLUVIUM)	7.15	0.08
8MW8D	48.00	78.00	19.53	17.14	2	OVERBURDEN (FILL) BEDROCK	6.43	0.84
8MW8S	7.00	17.00	19.68	17.29	2	OVERBURDEN (ALLUVIUM)/ BEDROCK	16.58	0.56 2.62
15MW1D	36.00	46.00	28.05	25.66	2	OVERBURDEN (ALLUVIUM)	14.67 9.22	16.44
15MW1S	5.00	15.00	28.08	25.69	2	OVERBURDEN (ALLUVIUM)	3.87	21.82
15MW2S	5.00	15.00	28.90	26.51	2	OVERBURDEN (ALLUVIUM)	4.61	21.90
15MW3S	5.00	15.00	26.26	23.87	2	OVERBURDEN (ALLUVIUM)	4.38	19.49
23MW01D	50.00	56.50	36.83	34.44	2	BEDROCK	3.85	30.59
23MW02D	18.60	28.50	23.19	20.80	8	BEDROCK	3.72	17.08
23MW03D	39.00	55.00	22.91	20.52	8	BEDROCK	1.1	19.42
ERM-1	3.54	13.04	22.49	20.10	2	OVERBURDEN (FILL)	4.25	15.85
ERM-13	5.50	14.55	25.52	23.13	2	OVERBURDEN (FILL)	6.02	17.11
ERM-14	5.50	14.28	25.21	22.82	2	OVERBURDEN (FILL)	5.69	17.13
ERM-15	2.25	11.25	22.63	20.24	2	OVERBURDEN (FILL)	3.46	16.78
ERM-17	2.72	11.72	22.15	19.76	2	OVERBURDEN (FILL)	4.09	15.67
ERM-19	2.81	11.81	22.03	19.64	2	OVERBURDEN (FILL)	4.13	15.51
ERM-2	3.71	13.21	21.46	19.07	2	OVERBURDEN (FILL)	3.81	15.26
HNUS-10	5.00	15.00	23.25	20.86	2	OVERBURDEN (FILL)	8.81	12.05
HNUS-11	5.00	15.00	22.23	19.84	2	OVERBURDEN (FILL)	8.63	11.21
HNUS-12	5.00	15.00	26.47	24.08	2	OVERBURDEN (FILL)	2.68	21.40
HNUS-13	5.00	15.00	25.71	23.32	2	OVERBURDEN (FILL)	1.22	22.10
HNUS-15	5.00	15.00	23.13	20.74	2	OVERBURDEN (FILL)	4.94	15.80
HNUS-2	4.00	14.00	20.70	18.31	2	OVERBURDEN (FILL)	4.82	13.49
HNUS-21	5.00	15.00	22.35	19.96	2	OVERBURDEN (FILL)	7	12.96
HNUS-22	10.00	20.00	27.70	25.31	2	OVERBURDEN (FILL)	9.78	15.53
HNUS-23	7.00	17.00	20.42	18.03	2	OVERBURDEN (FILL)	6.93-	11.10
HNUS-24	5.00	15.00	27.11	24.72	2	OVERBURDEN (FILL)	10.71	14.01
HNUS-4	4.00	14.00	21.24	18.85	2	OVERBURDEN (FILL)	4.32	14.53
HNUS-5	4.00	14.00	21.35	18.96	2	OVERBURDEN (FILL)	4.22	14.74
LOWER SUBA								
6MW1S	4.00	14.00	8.63	6.24	2	OVERBURDEN (FILL)	5.9	0.34
6MW2D	77.00	87.00	7.85	5.46	2	OVERBURDEN (ALLUVIUM)	4.51	0.95
6MW2S	3.20	13.20	7.30	4.91	2	OVERBURDEN (FILL/DREDGE)	4.5	0.41
6MW6D	28.00	42.00	12.50	10.11	6	BEDROCK	8.99	1.12
6MW6S	6.00	16.00	12.16	9.77	2	OVERBURDEN (FILL)	8.65	1.12
13MW12	5.30	15.30	9.21	6.82	2	OVERBURDEN (FILL)	6.34	0.48
13MW14	4.80	14.80	7.98	5.59	2 .	OVERBURDEN (FILL)	5.02	0.57

### TABLE 2-3

### SUMMARY OF WATER ELEVATIONS - AUGUST 2000 BASEWIDE GROUNDWATER OU RI NSB-NLON, GROTON, CONNECTICUT PAGE 2 OF 3

Well Name	Depth to Top of Screen (Feet)	Depth to Bottom of Screen (Feet)	Top of Casing Elevation 1982 Datum	Top of Casing Elevation 1988 Datum	Well Diameter	Aquifer Monitored	Depth to Water (feet) August 2000	Water Elevation (ft-msl)* August 2000
7MW7S	5.50	15.50	46.57	44.18	2	BEDROCK	2.45	41.73
7MW8S	3.00	13.00	42.10	39.71	2	OVERBURDEN (ALLUVIUM)	5.84	33.87
7MW9S	4.00	14.00	37.91	35.52	2	OVERBURDEN (ALLUVIUM)	5.88	29.64
B325-MW1	3.00	13.00	47.23	44.84	2	OVERBURDEN/BEDROCK	3.15	41.69
B325-MW3	2.50	12.50	46.05	43.66	2	OVERBURDEN	1.87	41.79
B325-MW4 ·	4.00	14.00	46.88	44.49	2	OVERBURDEN	4.07	40.42
14MW1S	4.00	14.00	51.44	49.05	2	OVERBURDEN (ALLUVIUM)	5.32	43.73
SOUTHERN REGI								
BMW1	6.40	16.40	10.15	7.76	2	OVERBURDEN (FILL)	8.70	-0.94
8MW10S	14.50	21.50	21.61	19.22	2	BEDROCK	16.35	2.87
BMW2D	54.00	64.00	9.77	7.38	2	OVERBURDEN (ALLUVIUM)	7.65	-0.27
BMW2S BMW3	5.90	15.90	9.43	7.04	2	OVERBURDEN (FILL)	7.03	0.01
BMW4	5.80	15.80	8.96	6.57	2	OVERBURDEN (FILL)	6.53	0.04
BMW5S	5.40	14.40	9.34	6.95	2	OVERBURDEN (FILL)	6.67	0.28
BMW6D	6.00	16.00	10.94	. 8.55	2	OVERBURDEN (FILL)	9.30	-0.75
BMW6S	60.00	70.00	9.62	7.23	2	OVERBURDEN (ALLUVIUM)	7.70	-0.47
BMW8D	4.00 48.00	14.00	9.66	7.27	2	OVERBURDEN (FILL)	6.96	0.31
BMW8S	7.00	78.00 17.00	19.53	17.14	2	BEDROCK	16.81	0.33
BMW9S	14.00	19.00	19.68	17.29	2	OVERBURDEN (ALLUVIUM)/ BEDROCK	15.24	2.05
15MW1D	36.00	46.00	21.40 28.05	19.01 25.66	2	BEDROCK	15.93	3.08
15MW1S	5.00	15.00	28.08	25.69	2	OVERBURDEN (ALLUVIUM)	9.98	15.68
15MW2S	5.00	15.00	28.90	26.51	2	OVERBURDEN (ALLUVIUM)	5.58	20.11
15MW3S	5.00	15.00	26.26	23.87	2	OVERBURDEN (ALLUVIUM)	6.36	20.15
23MW01D	50.00	56.50	36.83	34.44	2	OVERBURDEN (ALLUVIUM)	4.49	19.38
23MW01S	6.00	16.00	37.25	34.86	2	BEDROCK OVERBURDEN (ALLUVIUM)	4.65	29.79
23MW02D	18.60	28.50	23.19	20.80	8	BEDROCK	6.64	28.22
23MW02S	4.00	14.00	23.35	20.96	2	OVERBURDEN (ALLUVIUM)	6.11	14.69
3MW03D	39.00	55.00	22.91	20.52	8	BEDROCK	6.09	14.87
3MW04D	65.50	95.50	21.89	19.50	2	BEDROCK	7.19 7.44	13.33
3MW04S	45.00	55.00	21.56	19.17	2	OVERBURDEN (ALLUVIUM)	8.11	12.06
INUS-11	5.00	15.00	22.23	19.84	2	OVERBURDEN (FILL)	8.88	11.06
INUS-13	5.00	15.00	25.71	23.32	2	OVERBURDEN (FILL)	4.51	10.96 18.81
INUS-2	4.00	14.00	20.70	18.31	2	OVERBURDEN (FILL)	5.47	12.84
INUS-20	5.00	15.00	22.51	20.12	2	OVERBURDEN (FILL)	8.24	11.88
INUS-23	7.00	17.00	20.42	18.03	2	OVERBURDEN (FILL)	8.89	9.14
OWER SUBASE I	WELLS					OVER IDOVIDEN (I ICE)	0.03	3.14
OMW14	3.20	10.20	12.68	10.29	2	OVERBURDEN(FILL/ALLUVIUM)	9.35	0.94
W1-7RI	5.00	9.00	8.11	5.72	2	OVERBURDEN(FILL)	5.50	0.22
W2-3RI	3.00	8.00	7.78	5.39	2	OVERBURDEN(FILL)	5.94	-0.55
W2-6RI	3.00	8.00	6.02	3.63	2	OVERBURDEN(FILL)	3.00	0.63
IW3-6RI	3:00	8.00	6.31	3.92	2	OVERBURDEN(FILL)	3.31	0.61
W3-7RI	3.00	8.00	6.66	4.27	2	OVERBURDEN(FILL)	3.88	0.39
IW4-6RI	3.00	8.00	6.90	4.51	2	OVERBURDEN(FILL)	3.92	0.59
W4-7RI	3.00	8.00	8.06	5.67	2	OVERBURDEN(FILL)	5.50	
ESO10	4.30	9.30	8.10	5.71	2	OVERBURDEN (ALLUVIUM)		0.17
3MW1	7.49	17.49	13.36	10:97	2	OVERBURDEN (ALLUVIUM)	6.02 10.11	-0.31
3MW10	5.00	15.00	8.44	6.05	2	OVERBURDEN (ALLUVIUM)		0.86
3MW12	5.30	15.30	9.21	6.82	2	OVERBURDEN (ALLOVIOM)	6.12	-0.07
3MW14	4.80	14.80	7.98	5.59	2	OVERBURDEN (FILL)		0.44
3MW19	5.00	15.00	8.05	5.66	2	OVERBURDEN (FILL)	6.60	-1.01
BMW2	7.67	17.67	12.80	10.41	2	OVERBURDEN (ALLUVIUM)	4.58	1.08
BMW20	3.00	13.00	10.45	8.06	2	OVERBURDEN (ALLOVIUM)  OVERBURDEN (FILL)	9.49	0.92
BMW21	5.00	15.00	8.70	6.31	2		7.12	0.94
змуз	7.36	17.36	12.89	10.50	2 .	OVERBURDEN (FILL) OVERBURDEN (ALLUVIUM)	5.33	0.98

# APPENDIX B.6 SITE 7 - TORPEDO SHOPS SOIL DATA

# SUMMARY OF SITE 3 SOIL DATA -AREA A DOWNSTREAM BASEWIDE GROUDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GRORON, CONNECTICUT

## PAGE 1 OF 1

location	3SB14S3	3SB29D0	3SB29D1
matrix	SB	SB	SB
sample	S3SB14S3234	S3SB29D0911	S3SB29D1012
depth	32-34	09-11	10-12
sample_date	6/22/00	6/13/00	6/23/00
validated	TRUE	TRUE	TRUE
cto_proj	312	312	312
proj_manager	CERCONE, D.	CERCONE, D.	CERCONE, D.
Grain Size (%)			
SIEVE # 10		100	
SIEVE # 100		94.44	
SIEVE # 200		66.05	
SIEVE # 4		100	
SIEVE # 40		99.07	
SIEVE # 50		98.61	
SIEVE 1-1/2"		100	
SIEVE 1/2"		100	
SIEVE 3"	· ·	100	
SIEVE 3/4"		100	
SIEVE 3/8"		100	
Miscellaneous Parameters			
BULK DENSITY (LB/CU FT)		112.22	
PH		6.96	
POROSITY (N)		0.3306	
SPECIFIC GRAVITY		2.69	
TOTAL ORGANIC CARBON (MG/KG)	109 U		123 U

$$112.22 \frac{16}{ft^3} \Rightarrow 1.89 \frac{9}{cm^3}$$

$$Conv. = 0.016$$
FACTOR

# APPENDIX B.2

SITE 3 - AREA A DOWNSTREAM SOIL DATA

# SUMMARY OF SITE 7 SOIL DATA - TORPEDO SHOPS BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONNECTICUT

PAGE 1 OF 1

location	7SB01
matrix	SB
sample	S7SB010912
sacode	NORMAL
depth	09-12
sample_date	6/13/00
validated	TRUE
cto_proj	312
proj_manager	CERCONE, D.
Grain Size (%)	
SIEVE # 10	35.38
SIEVE # 100	27.44
SIEVE # 200	19.49
SIEVE # 4	45.71
SIEVE # 40	30.99
SIEVE # 50	29.82
SIEVE 1-1/2"	100
SIEVE 1/2"	63.77
SIEVE 3°	, 100
SIEVE 3/4°	100
SIEVE 3/8°	58.69
Miscellaneous Parameters	
BULK DENSITY (LB/FT)	98.77
PH	8.33
POROSITY(N)	0.3736
SPECIFIC GRAVITY	2.53

$$98.77 \frac{16}{43} \Rightarrow 1.58 = 1.68 \text{ g/cm}^3$$

$$\begin{bmatrix} \text{Conv.} & = 0.016 \\ \text{FACTOR} & \end{bmatrix}$$

**APPENDIX B.17** 

SITE 23 - TANK FARM SOIL DATA

### SUMMARY OF SITE 23 SOIL DATA TANK FARM BASEWIDE GROUNDWATER OPERABLE UNIT REMEDIAL INVESTIGATION NSB-NLON, GROTON, CONNECTICUT

### PAGE 1 OF 1

site	23	23
location	23SB02S	23SB04S
matrix	SB	SB
sample	S23SB02S0810	S23SB04S1012
depth	08-10	10-12
sample_date	6/13/00	6/13/00
validated	TRUE	TRUE
cto_proj	312	. 312
proj_manager	CERCONE, D.	CERCONE, D.
Grain Size (%)		
SIEVE # 10	87.69	97.51
SIEVE # 100	40.62	39.98
SIEVE # 200	25.12	17.01
SIEVE # 4	92.55	98.70
SIEVE # 40	65.74	87.00
SIEVE # 50	57.20	79.31
SIEVE 1-1/2"	100	100
SIEVE 1/2"	98.41	100
SIEVE 3"	100	100
SIEVE 3/4"	100	100
SIEVE 3/8"	97.22	99.57
Miscellaneous Parameters	<u> </u>	
BULK DENSITY (LB/CU FT)	90.83	90.75
PH	5.96	7.46
SPECIFIC GRAVITY	2.54	2.68
OTAL ORGANIC CARBON (MG/KG)	125 U	126 U
POROSITY (N)	0.4263	0.4567

$$90.8 \frac{16}{4^3} \Rightarrow 1.5 \frac{9}{0m^3}$$

$$\begin{bmatrix} conv. = 0.016 \end{bmatrix}$$

ATTACHMENT B
VAPOR INTRUSION MODELING PRINTOUTS

SITE 2
AREA A UPGRADIENT

RESIDENTIAL

GW-ADV	CALCULATE RIS	SK-BASED GROU	JNDWATER CONC	ENTRATION (en	ter "X" in "YES" bo	x)						
rsion 3.1; 02/04		YES		1								
Reset to		123	OR	J								
Defaults	CALCULATE IN	CREMENTAL RIS		GROUNDWAT	ER CONCENTRATI	ON (enter "X" in "YE!	S" box and initial grou	ndwater conc. be	low)			
		YES	X	1								
		153		J								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
*	67663	1.00E+00	_j ·		Chloroform							
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	
		Depth		Totals mu	st add up to value o				Soil.			=
MORE ¥	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
\	groundwater	of enclosed	below grade	of soil	stratum B	stratum C,	stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above	soil type	(used to estimate	OR	permeability,	
	T _S	LF	Lwt	h _A	h _B	hc	water table,	directly above	soil vapor		k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)	ı	(cm²)	
	11	15	190	190	0	0	A	SL	SL	[		
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE 🗸	Stratum A SCS	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
	soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	Lookup Soil	$\rho_b^A$	n ^A	θ,,^	Lookup Soil	ρ _b ^B	,n ^B	θ,,,,,	Lookup Soil	ρ _ь C	n ^c	θ"ς
	Parameters	(g/cm ³ )	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	SL	1.80	0.330	0.103		100	0.035		s I			0.054
	\ <u>\</u>	1.00	0.000							' 166 .	0.375	
MORE	ENTER				S	1.66	0.375	0.054	<del></del>	1.66	0.375	0.001
₩.O.K.E		ENTER	ENTER	, ENTER	ENTER	ENTER	ENTER	0.054	ENTER	1.66	0.375	0.001
	Enclosed space	ENTER Soil-bldg.	ENTER Enclosed space	ENTER Enclosed		· · · · · · · · · · · · · · · · · · ·		1 0.054	ENTER Average vapor	1.66	0.375	0.001
	Enclosed space floor	Soil-bldg. pressure	Enclosed space floor	ENTER Enclosed space floor	ENTER Enclosed space	ENTER Floor-wall seam crack	ENTER Indoor air exchange		ENTER Average vapor flow rate into bldg. OR		0.375	
	Enclosed space floor thickness,	Soil-bldg. pressure differential,	Enclosed space floor length,	ENTER Enclosed space floor width,	ENTER Enclosed space height,	ENTER Floor-wall seam crack width,	ENTER Indoor air exchange rate,		ENTER Average vapor flow rate into bidg. OR eave blank to calculat		0.375	
	Enclosed space floor thickness, L _{crack}	Soil-bldg. pressure differential, ΔP	Enclosed space floor length, L _B	ENTER Enclosed space floor width, We	ENTER Enclosed space height, H _B	ENTER Floor-wall seam crack width, w	ENTER Indoor air exchange rate, ER		ENTER Average vapor flow rate into bldg. OR eave blank to calculat		0.375	
	Enclosed space floor thickness, L _{crack} (cm)	Soil-bldg. pressure differential,	Enclosed space floor length, L _B (cm)	ENTER Enclosed space floor width, W _B (cm)	ENTER Enclosed space height, H _B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat		0.375	
	Enclosed space floor thickness, L _{crack}	Soil-bldg. pressure differential, ΔP	Enclosed space floor length, L _B	ENTER Enclosed space floor width, We	ENTER Enclosed space height, H _B	ENTER Floor-wall seam crack width, w	ENTER Indoor air exchange rate, ER		ENTER Average vapor flow rate into bldg. OR eave blank to calculat		0.375	0.00
MORE	Enclosed space floor thickness, L _{crack} (cm)	Soil-bldg. pressure differential,	Enclosed space floor length, L _B (cm)	ENTER Enclosed space floor width, W _B (cm)	ENTER Enclosed space height, H _B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	5.55
MORE +	Enclosed space floor thickness, Lorack (cm)	Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging	Enclosed space floor length, Ls (cm)	ENTER Enclosed space floor width, We (cm) 1000  ENTER	ENTER  Enclosed space height, He (cm)  244  ENTER Target	Floor-wall seam crack width, w (cm) 0.1  ENTER Target hazard	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE ¥	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for	Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for	Enclosed space floor length, L _B (cm) 1000 ENTER Exposure	ENTER Enclosed space floor width, We (cm)  1000  ENTER  Exposure	ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE ¥	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens,	Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging time for noncarcinogens	Enclosed space floor length, L _B (cm) 1000 ENTER Exposure	ENTER Enclosed space floor width, We (cm) 1000  ENTER	ENTER  Enclosed space height, He (cm)  244  ENTER Target	Floor-wall seam crack width, w (cm) 0.1  ENTER Target hazard	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE ¥	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for	Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for	Enclosed space floor length, L _B (cm)  ENTER  Exposure duration,	ENTER Enclosed space floor width, We (cm)  1000  ENTER  Exposure frequency,	ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for carcinogens,	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens,	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE ¥	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _c	Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging time for noncarcinogens $\Delta T_{NC}$	Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	ENTER Enclosed space floor width, We (cm)  1000  ENTER  Exposure frequency, EF	ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for carcinogens, TR	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE ¥	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _c (yrs)	Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens AT _{NC} (yrs)	Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF (days/yr)	ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for carcinogens, TR (unitiess)	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	
MORE V	Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _c (yrs)	Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens AT _{NC} (yrs)	Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF (days/yr)	ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for carcinogens, TR (unitless)	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{sol} (L/m)		0.375	

### CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

END

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wali seam perimeter,
t	L _T	θ _a ^	$\theta_a^{\ B}$	$\theta_a^c$	Ste	k _i	k _{rg}	k,	Lcz	n _{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X _{crack}
(sec)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm)
9.46E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
3.402.00	173	0.221	0.521	1 0.321	0.220	J.94L-09	1 0.079	J.22E-09	20.00	0.55	1 0.010	0.320	1 4,000
Bidg. ventilation rate, Q _{bullding} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ _{Ts} (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} A (cm²/s)	Stratum B effective diffusion coefficient, Deff (cm²/s)	Stratum C effective diffusion coefficient, Deff c (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	6.85E-03	0.00E+00	0.00E+00	2.48E-05	1.70E-04	175
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bidg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{orack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	8.38E+01	0.10	8.33E+01	6.85E-03	4.00E+02	1.29E+132	6.00E-05	5.03E-03	2.3E-05	4.9E-02	]		

**RESULTS SHEET** 

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

**INCREMENTAL RISK CALCULATIONS:** 

Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure	indoor	component	indoor		vapor	from vapor
groundwater conc., noncarcinogen (µg/L)	exposure groundwater conc., (µg/L)	water solubility, S (μg/L)	exposure groundwater conc., (μg/L)	· · · · · · · · · · · · · · · · · · ·	intrusion to indoor air, carcinogen (unitless)	intrusion to indoor air, noncarcinogen (unitless)
l NA	NΔ	7 92F+06	NΔ	· . 	4.8F-08	T 9.8E-05
	exposure groundwater conc., noncarcinogen	exposure indoor groundwater exposure conc., groundwater noncarcinogen conc., (μg/L)	exposure indoor component groundwater exposure water conc., groundwater solubility, noncarcinogen conc., S (μg/L) (μg/L)	exposure indoor component indoor groundwater exposure water exposure conc., groundwater solubility, groundwater noncarcinogen conc., S conc., (μg/L) (μg/L) (μg/L)	exposure indoor component indoor groundwater exposure water exposure conc., groundwater solubility, groundwater noncarcinogen conc., S conc., (μg/L) (μg/L) (μg/L)	Indoor Risk-based Pure Final risk from exposure indoor component indoor vapor groundwater exposure water exposure intrusion to conc., groundwater solubility, groundwater indoor air, noncarcinogen conc., S conc., carcinogen (μg/L) (μg/L) (μg/L) (μg/L) (unitless)

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## INCREMENTAL RISK CALCULATIONS:

Indoor	Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure groundwater conc., carcinogen (mg/L)	exposure groundwater conc., noncarcinogen (mg/L)	indoor exposure groundwater conc., (mg/L)	component water solubility, S (mg/L)	indoor exposure groundwater conc., (mg/L)	·	vapor intrusion to indoor air, carcinogen (unitless)	from vapor intrusion to indoor air, noncarcinogen (unitless)
2.10E+01	1.02E+04	2.10E+01	7.92E+06	2.10E+01	·	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

GW-ADV rersion 3.1; 02/04	CALCULATE RIS	SK-BASED GROUI	DWATER CONC	ENTRATION (en	iter "X" in "YES" box	<)						
Reset to		YES		]								
Defaults	CALCULATE INC	CREMENTAL RISK	OR S FROM ACTUAL	GROUNDWAT	ER CONCENTRATI	ON (enter "X" in "YE:	S" box and initial grou	Indwater conc. bel	ow)			
		YES	X	]				•				
•	ENTER	ENTER Initial										
	Chemical CAS No.	groundwater conc.,										
	(numbers only, no dashes)	C _w (μg/L)	_		Chemical			* -				
	79016	9.00E-01	]		Trichloroethyle	ne						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	]
MORE	Average	Depth below grade			st add up to value o	Thickness			Soil stratum A		User-defined	
<u> </u>	soil/ groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C,	Soil stratum	scs	SCS soil type	25	stratum A soil vapor	
	temperature, T _s	space floor, L _F	to water table, L _{w1}	stratum A,	(Enter value or 0) h ₈	(Enter value or 0)	directly above water table.	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	190	190	0	0	Α	SL	SL			i
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE ↓	Stratum A SCS	Stratum A soil dry		Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
	soil type Lookup Soil	bulk density, ρ _ι ^A	porosity, n ^A	porosity, θ _w ^A	soll type Lookup Soil	bulk density, ρ _b ⁸	porosity, n ^B	porosity, θ _w ^B	soil type Lookup Soil	bulk density, ρ _ь c	porosity, n ^C	porosity, θ _w ^C
	Parameters	FU										/3/3\
		(g/cm³)	(unitiess)	(cm³/cm³)	Parameters	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	SL		(unitless) 0.330	(cm³/cm³) 0.103	Parameters		(unitless) 0.375		s	(g/cm³)	(unitless) 0.375	(cm /cm )
MORE	SL ENTER Enclosed	(g/cm³) 1.80 ENTER	0.330  ENTER Enclosed	0.103 ENTER Enclosed	S	(g/cm ³ )  1.66  ENTER	(unitless) 0.375 ENTER	(cm ³ /cm ³ )	S ENTER Average vapor			
MORE ↓	SL ENTER Enclosed space floor	(g/cm³)  1.80  ENTER  Soil-bldg. pressure	0.330  ENTER Enclosed space floor	0.103  ENTER Enclosed space floor	S ENTER Enclosed space	(g/cm³)  1.66  ENTER  Floor-wall seam crack	(unitless)  0.375  ENTER Indoor air exchange	(cm³/cm³) } 0.054	ENTER Average vapor flow rate into bidg. OR	1.66		
	SL ENTER Enclosed space	(g/cm³)  1.80  ENTER  Soil-bldg.	0.330  ENTER Enclosed space	0.103  ENTER Enclosed space	S ENTER Enclosed	(g/cm³)  1.66  ENTER  Floor-wall	(unitless) 0.375 ENTER Indoor	(cm³/cm³) } 0.054	S  ENTER Average vapor flow rate into bidg.	1.66		
	SL  ENTER Enclosed space floor thickness,	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	0.330  ENTER Enclosed space floor length,	0.103  ENTER Enclosed space floor width,	S ENTER Enclosed space height,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width,	(unitless)  0.375  ENTER Indoor air exchange rate,	(cm³/cm³) } 0.054	ENTER Average vapor flow rate into bidg OR eave blank to calcular	1.66		
	SL  ENTER Enclosed space floor thickness, Lcrack	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP	0.330  ENTER Enclosed space floor length, L _B	ENTER Enclosed space floor width, W _B	S ENTER Enclosed space height,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	(unitless)  0.375  ENTER Indoor air exchange rate, ER	(cm³/cm³) } 0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calcular	1.66		
	SL  ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging	ENTER Enclosed space floor length, L _B (cm)	ENTER Enclosed space floor width, W _B (cm)	S ENTER Enclosed space height, H _B (cm) 244 ENTER Target	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard	(unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	(cm³/cm³) } 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcular O _{soil} (L/m)	1.66		
₩ORE	SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens,	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging time for noncarcinogens,	0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER Exposure duration,	0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER  Exposure frequency,	Enclosed space height, H _B (cm)  244  ENTER Target risk for carcinogens,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	(unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	(cm³/cm³) } 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcular O _{soil} (L/m)	1.66		
₩ORE	SL  ENTER Enclosed space floor thickness, L-crack (cm)  10  ENTER Averaging time for	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for	0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure	0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER  Exposure	S ENTER Enclosed space height, Hg (cm) 244 ENTER Target risk for	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	(unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	(cm³/cm³) } 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcular O _{soil} (L/m)	1.66		
₩ORE	SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Exposure frequency, EF	Enclosed space height, HB (cm)  244  ENTER Target risk for carcinogens, TR	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	(unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	(cm³/cm³) } 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcular O _{soil} (L/m)	1.66		
₩ORE	SL  ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _c (yrs)	(g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$ (yrs)	0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER  Exposure frequency, EF (days/yr)	Enclosed space height, H _B (cm)  244  ENTER  Entrer  Target risk for carcinogens, TR (unitless)	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)  1 ate risk-based	(unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	(cm³/cm³) } 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcular O _{soil} (L/m)	1.66		

## CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm²/s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

	Exposure duration,	Source- building separation,	Stratum A soil air-filted porosity, $\theta_a^A$	Stratum B soil air-filled porosity, $\theta_a^B$	Stratum C soil air-filled porosity, $\theta_a^C$	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
_	(sec)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	κ _ι (cm²)	κ _{rg} (cm²)	(cm²)	(cm)	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	X _{crack} (cm)
-	- 105.00	1						<del></del>						
L	9.46E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
	Bidg. ventilation rate,	Area of enclosed space below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient	Total overall effective diffusion coefficient,	Diffusion path length,
	Q _{building}	A _B	η	$Z_{crack}$	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	μτς	Deff _A	D ^{eff} B	D ^{eff} c	D ^{eff} cz	${\mathsf D}^{eff}{}_{\mathsf T}$	La
	(cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
Г	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	6.12E-05	175
	1.002.04	1.002.00	0.772-04	1. 10	0,544	1 0.002-03	2.172-01	1.702-04	3.20E-03	0.00E+00	0.002700	0.03E-06	0.12E-05	1/5
	Convection	Source		Average vapor	Crack effective		Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit				
	path	vapor	Crack	flow rate	diffusion	Area of	Peclet	attenuation	bldg.	risk	Reference			
	length,	conc.,	radius,	into bldg.,	coefficient, D ^{crack}	crack,	number,	coefficient,	conc.,	factor,	conc.,			
	Lp	C _{source}	r _{crack}	Q _{soil}	-	A _{crack}	exp(Pe ^r )	α	C _{building}	URF	RfC			
-	(cm)	(μg/m³)	(cm)	(cm³/s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(μg/m³)	(μg/m³) ⁻¹	(mg/m³)			
	15	1.95E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	2.18E-05	4.24E-03	1.1E-04	3.5E-02	]		

**RESULTS SHEET** 

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	-   [	1.9E-07	1.2E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
4.69E+00	7.74E+03	4.69E+00	1.47E+06	4.69E+00	[	NA NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

GW-ADV rsion 3.1; 02/04	CALCULATE RIS	SK-BASED GROU	INDWATER CONC	ENTRATION (en	ter "X" in "YES" bo	x)						
Reset to		YES	OR	]								
Defaults	CALCULATE IN	CREMENTAL RIS		GROUNDWATE	ER CONCENTRAT	ON (enter "X" in "YE	S" box and initial groun	ndwater conc. bei	low)			
		YES	X	]				*				
	ENTER	ENTER										
	Chemical	Initial groundwater				•						
	CAS No. (numbers only,	conc., C _w (μg/L)			Chemical							
	no dashes)		<del></del>				' . •					
	79016	9.00E-01	* 1		Trichloroethyle	ene					· .	_
	ENTER	ENTER Depth	ENTER	ENTER Totals mus	ENTER st add up to value o	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE ¥	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soll		stratum A SCS		User-defined stratum A	
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type (used to estimate	OR .	soil vapor permeability	
	T _s (°C)	L _F (cm)	L _{WT} (cm)	h _A (cm)	h _B (cm)	h _c (cm)	water table, (Enter A, B, or C)	directly above water table	soil vapor permeability)		k _v (cm²)	
			190		0	(cit)	A	SL	SL		(0,1.7	
	11	15	1 190	190		<u> </u>	<u> </u>	] JL	1 31.			<b>.</b>
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
WOKE 4	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	soil type	bulk density, ρ _ь ^A	porosity, n ⁴	porosity, θ _w ^A	Lookup Soil	bulk density, ρ _ь ^в	u _B	θ _w B	Lookup Soil Parameters	ρ _b C	n ^C	θ _w .c
	Parameters	(g/cm ³ )	(unitiess)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	SL	1.80	0.330	0.103	S	1.66	0.375	0.054	s	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
<u> </u>	space	Soil-bldg. pressure	space floor	space floor	Enclosed space	Floor-wall seam crack	Indoor air exchange		flow rate into bldg. OR			
	thickness,	differential,	length,	width,	height,	width,	rate,	ı ı	eave blank to calcula	te		
		ΔΡ	L _B	W _B	H _B	widai,	ER.		Q _{soil}			
	L _{orack} (cm)							•				
	L _{crack}	ΔР	L _B	W _B	He	w	ER	• ]	Q _{soil}			
MORE	L _{crack} (cm)	ΔP (g/cm-s ² ) 40 ENTER	L _B (cm)	W _B (cm)	H _B (cm) 244 ENTER	(cm) 0.1	ER (1/h)	• ]	Q _{soil} (L/m)			
MORE ↓	Lorack (cm)  10  ENTER Averaging time for	(g/cm-s²)  40  ENTER Averaging time for	(cm) 1000 ENTER Exposure	W _B (cm)  1000   ENTER  Exposure	H _B (cm)  244  ENTER Target risk for	(cm)  0.1  ENTER Target hazard quotient for	ER (1/h)	]	Q _{soil} (L/m)			
	Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C	ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens AT _{NC}	(cm)  1000  ENTER  Exposure duration, ED	W _B (cm)  1000    ENTER  Exposure frequency, EF	H ₉ (cm)  244  ENTER Target risk for carcinogens, TR	W (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	ER (1/h)	1	Q _{soil} (L/m)			
	Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C (yrs)	ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens AT _{NC} (yrs)	L ₈ (cm)  1000  ENTER  Exposure duration, ED (yrs)	W _B (cm)  1000    ENTER  Exposure frequency, EF (days/yr)	H _B (cm)  244  ENTER Target risk for carcinogens, TR (unitless)	W (cm)  0.1  ENTER Target hazard quotient for noncarcinogens,	ER (1/h)	•	Q _{soil} (L/m)			
	Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C	ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens AT _{NC}	(cm)  1000  ENTER  Exposure duration, ED	W _B (cm)  1000    ENTER  Exposure frequency, EF	H _B (cm)  244  ENTER Target risk for carcinogens, TR (unitless)	W (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ER (1/h)		Q _{soil} (L/m)			

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

	Exposure duration,	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity, θ _a ^C	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability, k	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k _v	Thickness of capillary zone,	Total porosity in capillary zone, n _{ez}	Air-filled porosity in capillary zone, θ _{acz}	Water-filled porosity in capillary zone,	Floor- wall seam perimeter, X _{creck}
	(sec)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm)
=	1000/				<b>,</b>		\ <u>\</u>	<u> </u>	\\		, contract of			<u> </u>
	9.46E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
	Bldg. ventilation rate,	Area of enclosed space below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	Diffusion path length,
	Q _{building}	A _B	η	Z _{crack}	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	$\mu_{TS}$	Deff	D ^{eff} B	Deff	D ^{eff} cz	D ^{eff} T	La
_	(cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	6.12E-05	175
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (μg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
	45	4.055.00	0.40	0.005.04	5 205 22	4.005.00	0.445.472	2.18E-05	4.24E-03	2.0E-06	6.0E-01			
L	15	1.95E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	4.10E-V3	1 4.24E-U3	2.02-00	0.0E-01	j		

**RESULTS SHEET** 

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	] • [	3.5E-09	6.8E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

#### RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

**INCREMENTAL RISK CALCULATIONS:** 

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Increm risk fr vap intrusid indoor carcind (unitle	om quotien or from vap on to intrusion air, indoor ai ogen noncarcino	t or to ir, ogen
2.58E+02	1.33E+05	2.58E+02	1.47E+06	2.58E+02	] NA	NA NA	

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

GW-ADV /ersion 3.1; 02/04	CALCULATE RIS	K-BASED GROUN	NDWATER CONC	ENTRATION (en	ter "X" in "YES" bo	×)						
Reset to		YES	OR									
Defaults	CALCULATE INC	REMENTAL RISK		GROUNDWAT	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER Initial										
	Chemical	groundwater										
	CAS No. (numbers only,	conc., C _w									•	
	no dashes)	(μg/L)			Chemical							
	67663	1.00E+00		L	Chloroform							
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER st add up to value o	ENTER of Last (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	•
MORE	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
<u> </u>	groundwater	of enclosed space floor,	below grade to water table,	of soil stratum A,	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type (used to estimate	OR	soil vapor permeability,	
	temperature, T _S	L _F	L _{wt}	h _A	h _B	h _C	water table,	directly above	soil vapor	Oit	k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	•
	11	15	190	190	0	0	Α	SL	SL			<b>J</b> .
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
MORE +	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
MORE	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_{w}^{A}$	Stratum B SCS soil type	Stratum B soil dry bulk density, ρ _b ^B	Stratum B soil total porosity, t ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soit water-filled porosity, $\theta_w^C$
MORE ¥	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, ρ _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $ ho_b^B$ (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE ↓	Stratum A SCS Soil type Lookup Soil Parameters	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $\rho_b^B$ (g/cm³)	Stratum B soil total porosity,  t  (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soit water-filled porosity, $\theta_w^C$
MORE	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, ρ _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Sol Parameters S ENTER	Stratum B soil dry bulk density, p. 8 (g/cm³)  1.66  ENTER	Stratum B soil total porosity,	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
	Stratum A SCS SOII type Lookup Soil Parameters  SL ENTER	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, e _w ^A (cm ³ /cm ³ )  0.103  ENTER	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $\rho_b^B$ (g/cm³)	Stratum B soil total porosity,  t  (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS SOII type Lookup Soil Parameters S ENTER	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the filled porosity of the fil	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p. 8 (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity,  t ^B (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	Stratum A soil dry bulk density, Ph (g/cm³)  1.80  ENTER  Soil-bldg. pressure	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor	Stratum A soil water-filled porosity, \$\theta_{\text{w}}^{} \ (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space	Stratum B soil dry bulk density, p.8 (g/cm³)  1.66  ENTER  Floor-wall seam crack	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS SOII type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lcrack	Stratum A soil dry bulk density, \$\rho_b^A\$ (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, \$\rho P\$	Stratum A soil total porosity, n* (unitless)  0.330  ENTER Enclosed space floor length, LB	Stratum A soil water-filled porosity, the water-filled porosity, the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water filled porosity of the water	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p. B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity,	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil}	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER	Stratum A soil dry bulk density, Ph (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_{\text{\chi}}\$ (cm^3/cm^3) \$\$ 0.103 \$\$ ENTER Enclosed space floor width, \$W_8\$ (cm)	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Qaoil (L/m)	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE +	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for	Stratum A soil total porosity, n* (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\theta_*^\ (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width, \$W_8\$ (cm)  1000  ENTER  Exposure	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, He (cm) 300 ENTER Target risk for	Stratum B soil dry bulk density, p. B. (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Qaoil (L/m)	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\theta_w^*\$ (cm³/cm³) \$0.103\$  ENTER Enclosed space floor width, \$W_B\$ (cm) \$1000\$  ENTER	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Qaoil (L/m)	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lcrack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration,	Stratum A soil water-filled porosity, \$\theta_{\text{\chi}}\$ (cm^3/cm^3) \$\$ 0.103 \$\$ ENTER Enclosed space floor width, \$W_{\text{\chi}}\$ (cm) \$\$ 1000 \$\$ ENTER Exposure frequency,	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, P.B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Qaoil (L/m)	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Ph (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, \$\theta_{\text{\chi}}\$ (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width, \$W_8\$ (cm)  1000  ENTER  Exposure frequency, \$\text{EF}\$	Stratum B SCS soil type Lookup Soll Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, t ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 9,8 (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Qaoil (L/m)	Stratum C soli dry bulk density, $\rho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$

# CHEMICAL PROPERTIES SHEET

Diffusivit in air, D _a (cm ² /s)	in water, D _w	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m³)
1.04E-0	1 1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	$\theta_a^{A}$	$\theta_a^B$	$\theta_a^c$	Ste	k _i	k _{rg}	k,	L _{cz}	n _{cz}	⊕ _{a,cz}	θ _{w,cz}	X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
7.88E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
	· · · · · · · · · · · · · · · · · · ·												
	Area of enclosed	Crack-	Crack ·	Enthalpy of	Henry's law	Henry's law	Vapor	Stratum A	Stratum B	Stratum C	Capillary zone	Total overall	Diffi.a.
Bidg. ventilation	space below	to-total area	depth below	vaporization at ave. groundwater	constant at ave. groundwater	constant at ave. groundwater	viscosity at ave. soil	effective diffusion	effective diffusion	effective diffusion	effective diffusion	effective diffusion	Diffusion path
rate,	grade,	ratio,	grade,	temperature,	temperature,	temperature,	temperature,	coefficient,	coefficient,	coefficient,	coefficient,	coefficient,	length,
Q _{bullding}	A _B	η	Z _{crack}	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	μτε	D ^{eff} _A	D ^{eff} _B	D ^{eff} c	D ^{eff} cz	D ^{eff} _T	La
(cm ³ /s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm ² /s)	(cm²/s)	(cm²/s)	(cm)
	· · · · · · · · · · · · · · · · · · ·			r = 2''						T	T		T
6.92E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	6.85E-03	0.00E+00	0.00E+00	2.48E-05	1.70E-04	175
			Average	Crack		Exponent of equivalent	Infinite source	infinite					
Convection	Source		vapor	effective		foundation	indoor	source	Unit				
path	vapor	Crack	flow rate	diffusion	Area of	Peclet	attenuation	bldg.	risk	Reference			
length,	conc.,	radius,	into bldg.,	coefficient,	crack,	number,	coefficient,	conc.,	factor,	conc.,			
Lp	C _{source}	r _{creck}	Q _{sol}	D ^{crack}	A _{crack}	exp(Pe ^r )	α	C _{building}	URF	RfC			
(cm)	(μg/m³)	(cm)	(cm ³ /s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(μg/m³)	(μg/m³) ⁻¹	(mg/m³)			
15	8.38E+01	0.10	8.33E+01	6.85E-03	4.00E+02	1.29E+132	1.47E-05	1.23E-03	2.3E-05	4.9E-02	1		
1.0	1 0.30E-701	0.10	1 0,000,01	L 0.00E-00	1. 4.000-102	1.2061102	1.7/12-00	1.201-00	2.02-00	1 7.06-02	<b>.</b>		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	7.92E+06	NA	-   [	6.9E-09	1.7E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

**PRG SHEET** 

#### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	ris \ intr ind car	remental sk from vapor rusion to loor air, cinogen nitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.44E+02	5.81E+04	1.44E+02	7.92E+06	1.44E+02		NA	l NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV	CALCULATE R	ISK-BASED GROU	INDWATER CONC	ENTRATION (	enter "X" in "YES" bo	ox)						
ersion 3.1; 02/04		YES		7								
Reset to		123	OR	J.								
Defaults	CALCULATE IN	CREMENTAL RIS		GROUNDWA	TER CONCENTRAT	FION (enter "X" in "YE	ES" box and initial grou	indwater conc. be	low)			
		YES		7					,			
		162	X	j								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
			<del></del>	*	Chemical		•					
	79016	5.00E-01	J		Trichloroethyl	ene	]					
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	······································	ENTER	7
		Depth			ust add up to value o	of L _{wT} (cell G28)		LITTER	Soil		ENIER	
MORE ¥	Average soil/	below grade to bottom	Depth	Thickness	Thickness	Thickness			stratum A		User-defined	
<del></del>	groundwater	of enclosed	below grade	of soil	of soil stratum B,	of soil stratum C,	Soil stratum	scs	SCS		stratum A	1
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above	soil type	soil type (used to estimate	OR	soil vapor permeability,	
	Ts	L _F	L _{wt}	h _A	h _B	h _C	water table,	directly above	soil vapor	•	k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	j
	11	15	1 190	190	0	0	A	SL	CI	1		Ì
					<u> </u>			1 31	SL	L	<u> </u>	ŀ
	ENTER	ENTER	ENTER	ENTER	ENTER	FUTEO						
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER	ENTER
Ψ	scs	soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	Stratum C soil total	Stratum C soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
	Lookup Soil Parameters	ρ ₆ ^A	n ^A	θ,,Α	Lookup Soil Parameters	$\rho_b^B$	n ^B (	θ <b>″</b> Β	Lookup Soil	ρ _b C	n ^C	e,,c
		) (g/cm ³ )	(unitless)	(cm ³ /cm ³ )	Falanteters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	SL	1.80	0.330	0.103	S	1.66	0.375	0.054	S	1.66	0.375	0.054
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER					
MORE	Enclosed		Enclosed	Enclosed	LIVILIX	ENIER	ENIER		ENTER Average vapor			
<u> </u>	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		flow rate into bidg.			
	floor thickness,	pressure differential,	floor length,	floor	space	seam crack	air exchange	* *	OR			
	L _{crack}	ΔP	L _B	width, W _B	height, H _B	width, w	rate, ER	Le	eave blank to calcula	ite		
	(cm)	(g/cm-s²)	(cm)	(cm)	(cm)	(cm)	(1/h)		Q _{soil} (L/m)			
								•	\C/11/	•		
	10	40	1000	1000	300	0.1	0.83	] [	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
<u> </u>	Averaging	Averaging	<b>5</b>		Target	Target hazard						
	time for carcinogens,	time for noncarcinogens,	Exposure duration,	Exposure frequency,	risk for	quotient for						
	AT _C	AT _{NC}	ED.	EF	carcinogens, TR	noncarcinogens, THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)				•		
* .	70	25	25	250	1.0E-06	1						
!												
END					Used to calcul							
					groundwater of	concentration.						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^{\ B}$ $(cm^3/cm^3)$	Stratum C soil air-filled porosity, $\theta_a^{\ C}$ (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
Bidg. ventilation rate, Q _{bulkling} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔΗ _{ν,TS} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, µrs (g/cm-s)	Stratum A effective diffusion coefficient, Deff (cm²/s)	Stratum  B  effective  diffusion  coefficient,  Deff  (cm²/s)	Stratum C effective diffusion coefficient, Deffic (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, $D^{eff}_{T}$ (cm ² /s)	Diffusion path length,
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	6.12E-05	175
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, ^r crack (cm)	Average vapor flow rate into bldg., Q _{soil} (cm³/s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ¹	Reference conc., RfC (mg/m³)			
15	1.08E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	5.34E-06 \	5.78E-04	1.1E-04	3.5E-02	]		

#### **RESULTS SHEET**

## RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA NA	NA NA	NA	1.47E+06	NA	·	1.6E-08	1.1E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

#### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.22E+01	4.42E+04	3.22E+01	1.47E+06	3.22E+01	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

GW-ADV	CALCULATE RIS	SK-BASED GROUN	NDWATER CONC	ENTRATION (en	ter "X" in "YES" bo	x)						
Version 3.1; 02/04			<del></del>	-								
Reset to		YES	OR	J								
Defaults	CALCULATE INC	TOCMENTAL DICK		CPOLINDWAT	ED CONCENTRAT	ION (enter "V" in "VE	S" box and initial grou	ndwater conc. hel	ow)			
	CALCOLA IL INC	SALMENTAL RIGA	O FROM ACTUAL	GROONDWAT	EK CONCENTION	ION (enter X III ) FE	3 DOX and milital grou	INGWARE CONC. DE	O# <i>)</i>			
		YES	X	]								
	ENTER	ENTER					4	4				
	ENTER	Initial										
	Chemical CAS No.	groundwater										
	(numbers only,	conc., C _w										
	no dashes)	(μg/L)	-		Chemical							
	79016	9.00E-01	· .		Triphlomothyle		· }					
	73010	3.00E-01			Trichloroethyle	ile						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	1
NOOF	A	Depth		Totals mu	st add up to value o Thickness				Soil		Lleas defined	
MORE	Average soil/	below grade to bottom	Depth	Thickness	of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	ļ
	groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
	Ts	L _F	L _{WT}	h _A	h _B	h _c	water table,	directly above	soil vapor		k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	190	190	0	0	Α	SL	SL			1
	· · · · · · · · · · · · · · · · · · ·	<del></del>	<del>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</del>	<del></del>		<del></del>						•
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	Stratum C
MORE ↓	Stratum A	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
MORE ↓	Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
MORE ¥	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density,	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density, $ ho_b^{\ B}$	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{w}^{C}$
MORE ↓	Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
MORE ¥	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density,	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density, $ ho_b^{\ B}$	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\mathbf{C}}$
MORE V	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
	Stratum A SCS soil type Lookup Soil Parameters SL ENTER	Stratum A soil dry bulk density, p _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, e _w ^A (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p. ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE ↓	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ . MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	Stratum A soil dry bulk density, pb ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor	Stratum A soil water-filled porosity, θ _w ^ (cm³/cm³)  0.103  ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space	Stratum B soil dry bulk density, p.5 (g/cm³)  1.66  ENTER  Floor-wall seam crack	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ . MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, \$\rho_b^A\$ (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	Stratum A soil total porosity, n* (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, \$\theta_w^A\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p.6 (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ . MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, Pb^A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, e.g., (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p. 6 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ . MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, \$\rho_b^A\$ (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	Stratum A soil total porosity, n* (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, \$\theta_w^A\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p.6 (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ . MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, Pb^A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, e.g., (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p. 6 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE 4	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-track (cm)	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_w^A\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width, \$\text{W}_B\$ (cm)	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p. 6 (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup 5oil Parameters  SL ENTER Enclosed space floor thickness, L-crack (cm)  10 ENTER	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)	Stratum A soil water-filled porosity, \$\theta_{\text{s}}^{\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/\text{cm}^3/cm	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER	Stratum B soil dry bulk density, p e (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE 4	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-track (cm)	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_w^A\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width, \$\text{W}_B\$ (cm)	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p. 6 (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-crack (cm)  10 ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Le (cm)  1000  ENTER  Exposure duration,	Stratum A soil water-filled porosity, \$\theta_{\text{\chi}}^{\text{\chi}} (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width, \$\text{\chi} \text{\chi} (cm)\$  1000  ENTER  Exposure frequency,	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-track (cm)  10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, pb 4 (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, \$\theta_w^*\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width, \$W_B\$ (cm)  1000  ENTER  Exposure frequency, EF	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p.8 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-crack (cm)  10 ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Le (cm)  1000  ENTER  Exposure duration,	Stratum A soil water-filled porosity, \$\theta_{\text{\chi}}^{\text{\chi}} (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width, \$\text{\chi} \text{\chi} (cm)\$  1000  ENTER  Exposure frequency,	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-track (cm)  10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, pb 4 (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity,	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p.8 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-crack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, \$\rho_b^A\$ (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, \$\rho_P\$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, \$AT_{NC}\$ (yrs)	Stratum A soil total porosity, n* (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_w^*\$ (cm³/cm³)  0.103  ENTER Enclosed space floor width, \$W_B\$ (cm)  1000  ENTER  Exposure frequency, EF	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, Hs (cm) 300 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, p.8 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Peremeters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat Qsoil (L/m)	Stratum C soil dry bulk density, p _b c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$

## CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, 9 _a ^C (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w.cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	175	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
Bldg. ventilation rate, Q _{bulding} (cm³/s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm²/s)	Stratum B effective diffusion coefficient, Deff _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	6.12E-05	175
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, ^F crack (cm)	Average vapor flow rate into bldg.,  Q _{soi} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	1.95E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	5.34E-06	1.04E-03	2.0E-06	6.0E-01			*

## RESULTS SHEET

#### RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

#### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA NA	NA	NA	1.47E+06	NA	5.1E-10	1.2E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.77E+03	7.58E+05	1.77E+03	1.47E+06	1.77E+03	NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 2
AREA A DOWNSTREAM

RESIDENTIAL

#### DATA ENTRY SHEET

	GW-ADV	CALCULATE RE	SK-BASED CDOL	INDWATED COM	251501501	nter "X" in "YES" bo							
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<u> </u>		CALCULATE IN	CREMENTAL RISI	KS FROM ACTUA	L GROUNDWA	TER CONCENTRAT	FION (enter "X" in "YE	ES" box and initial grou	indwater conc. he	alow)			
					_		•			olow)			
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		ENTER	ENTER										
			Initial										
		Chemical	groundwater										
		CAS No.	conc.,										
		(numbers only,	Cw										
		no dashes)	(μg/L)			<u>.</u>							
		110 (0001100)	(µg/L)		*	Chemical				•			
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	MORE	Average	below grade		Totals IIIc					Soil			ļ
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	····	groundwater	of enclosed	below grade	Thickness	of soil	of soil	Soil		SCS		stratum A	
		temperature,	space floor,		of soil	stratum B,	stratum C,	stratum	SCS	soil type		soil vapor	İ
		T _s		to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
			LF	Lwt	h _A	h _B	h _C .	water table,	directly above	soil vapor		k _v	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	ľ ·		_	
								(2.1.6.74, 2, 6.6)	water table	permeability)		(cm²)	
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									SL	SL			
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTED	CNITCO					
	MORE	ENTER Stratum A	ENTER Stratum A		ENTER Stratum A	ENTER Stratum B	ENTER Stanton D	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
	MORE +		Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	ENTER Stratum C	ENTER Stratum C
		Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry		
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS	Stratum C soil dry bulk density,	Stratum C soil total	Stratum C soil water-filled
		Stratum A SCS	Stratum A soil dry bulk density, Pb	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density, Pb B	Stratum B soil total porosity, n ⁸	Stratum B soil water-filled porosity, $\theta_w^{\ B}$	Stratum C SCS soil type	Stratum C soil dry bulk density, $\rho_b^c$	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\text{C}}$
		Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, ρ _b ^Δ (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type	Stratum B soil dry bulk density, P _b ^B (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, $ ho_b{}^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
		Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, θ,, (cm³/cm³)	Stratum B SCS soil type Loókup Soil Parameters	Stratum B soil dry bulk density, Pb B	Stratum B soil total porosity, n ⁸	Stratum B soil water-filled porosity, $\theta_w^{\ B}$	Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density, $\rho_b^c$	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\text{C}}$
		Stratum A SCS soil type Lookup Soil Parameters  SL ENTER	Stratum A soil dry bulk density, ρ _b ^Δ (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, θ,, (cm³/cm³)	Stratum B SCS Soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $ ho_b^B$ (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS Soil type Lookup Soil Parameters	Stratum C soil dry bulk density, $ ho_b{}^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed	Stratum A soil dry bulk density, p _b ^A (g/cm ³ ) 1.80	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, θ _w ^A (cm³/cm³)	Stratum B SCS soil type Loókup Soil Parameters	Stratum B soil dry bulk density, P _b ^B (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters S ENTER	Stratum C soil dry bulk density, $ ho_b{}^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
		Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity,	Stratum B SCS Soil type Lodkup Soil Parameters S ENTER	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1.66	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor	Stratum C soil dry bulk density, $ ho_b{}^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	Stratum A soil dry bulk density, p _b ^A (g/cm ³ ) 1.80	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed	Stratum A soil water-filled porosity,	Stratum B SCS soil type Loökup Soil Parameters S ENTER Enclosed	Stratum B soil dry bulk density, Pb (g/cm³)  1,66   I ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor	Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg.	Stratum C soil dry bulk density, $ ho_b{}^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space	Stratum A soil dry bulk density, p.h (g/cm³)  1.80  ENTER  Soil-bldg.	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor	Stratum A soil water-filled porosity, θ, Δ (cm³/cm³)  0.103  ENTER Enclosed space floor	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )  1.66    ENTER  Floor-wall seam crack	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, ps (g/cm³)  1.80  ENTER  Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width,	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soir Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS Soil type Lookup Soil Parameters SL ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, $\theta_w^A$ (cm ³ /cm ³ )  0.103  ENTER Enclosed space floor width, $W_B$	Stratum B SCS soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER indoor air exchange rate, ER	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width,	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soir Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L _{crack} (cm)	Stratum A soil dry bulk density, ps (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p 8 (g/cm³)  1.66    ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER indoor air exchange rate, ER	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soir Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE	Stratum A SCS Soil type Lookup Soil Parameters SL ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, $\theta_w^A$ (cm ³ /cm ³ )  0.103  ENTER Enclosed space floor width, $W_B$	Stratum B SCS soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER indoor air exchange rate, ER	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack (cm)	Stratum A soil dry bulk density, p. A (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, 0, % (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1,66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soir Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL ENTER Enclosed space floor thickness, Lerack (cm)  10 ENTER	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, Ap (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER	Stratum B soil dry bulk density, p 8 (g/cm³)  1.66    ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging	Stratum A soil dry bulk density, p. A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103 ENTER Enclosed space floor width, Ws (cm) 1000 ENTER	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1,66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lcrack (cm)  10  ENTER Averaging time for	Stratum A soil dry bulk density, pb A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure	Stratum A soil water-filled porosity, $\theta_w^A$ , $(cm^3/cm^3)$ 0.103  ENTER Enclosed space floor width, $W_B$ , $(cm)$ 1000  ENTER  Exposure	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for	Stratum B soil dry bulk density, p b (g/cm³)  1.66 I  ENTER  Floor-wall seam crack width, w (cm)  0.1 ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL  ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103 ENTER Enclosed space floor width, Ws (cm) 1000 ENTER	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for	Stratum B soil dry bulk density, \$\rho_e^8\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L _{crack} (cm)  10 ENTER Averaging time for carcinogens, AT _C	Stratum A soil dry bulk density, ps (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure	Stratum A soil water-filled porosity, $\theta_w^A$ , $(cm^3/cm^3)$ 0.103  ENTER Enclosed space floor width, $W_B$ , $(cm)$ 1000  ENTER  Exposure	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, PB (g/cm³)  1.66 I  ENTER  Floor-wall seam crack width, W (cm)  0.1 ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL  ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, WB (cm) 1000   ENTER Exposure frequency, EF	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, \$\rho_0^8\$ (g/cm³)  1.66   ENTER  Floor-wall seam crack width, w (cm)  0.1   ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL ENTER Enclosed space floor thickness, Lcrack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, ps (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, 9, ^ (cm³/cm³) 0.103  ENTER Enclosed space floor width, W _B (cm) 1000  ENTER Exposure frequency,	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, PB (g/cm³)  1.66 I  ENTER  Floor-wall seam crack width, W (cm)  0.1 ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L _{crack} (cm)  10 ENTER Averaging time for carcinogens, AT _C	Stratum A soil dry bulk density, ps (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, 9 cm s cm s cm s cm s cm s cm s cm s cm	Stratum B SCS soil type Lodkup Soil Parameters  S ENTER Enclosed space height, Hs (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, \$\rho_{B}^{B}\$ (g/cm^{3})  1.66   ENTER  Floor-wall seam crack width, w (cm)  0.1   ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL ENTER Enclosed space floor thickness, Lcrack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{ncc} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, 9, 4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, WB (cm) 1000   ENTER Exposure frequency, EF	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, \$\rho_0^8\$ (g/cm³)  1.66   ENTER  Floor-wall seam crack width, w (cm)  0.1   ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL ENTER Enclosed space floor thickness, Lcrack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{ncc} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, 9 cm s cm s cm s cm s cm s cm s cm s cm	Stratum B SCS Soil type Lodkup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR (unitless) 1.0E-06	Stratum B soil dry bulk density, \$\rho_{\text{p}}^{\text{9}}\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, \$w\$ (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$
	MORE V	Stratum A SCS Soil type Lookup Soil parameters  SL ENTER Enclosed space floor thickness, Lcrack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{ncc} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, 9 cm s cm s cm s cm s cm s cm s cm s cm	Stratum B SCS soil type Lodkup Soil Parameters  S ENTER Enclosed space height, Hs (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, \$\rho_8^8\$ (g/cm^3)  1.66	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ, ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soif Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_{w}^{C}$ $(cm^{3}/cm^{3})$

## CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposure duration, τ (sec)	Source- building separation, L ₁ (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
9.46E+08	95	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H1s (atm-m3/mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum  A  effective diffusion coefficient, Deff A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{off} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	3.34E-05	95
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)	1 3.33E-V0	3.342-03	93
15	4.33E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	2.19E-05	9.48E-03	1.1E-04	3.5E-02	· · · · · · · · · · · · · · · · · · ·		

**RESULTS SHEET** 

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA NA	NA NA	NA	1.47E+06	NA	] [	4.3E-07	2.6E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	
4.67E+00	7.70E+03	4.67E+00	1.47E+06	4.67E+00		NA I	

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Chuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box) Version 3.1; 02/04 YES Reset to OR Defaults CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below) X ENTER ENTER Initial Chemical groundwater CAS No. conc., Cw (numbers only, no dashes) (µg/L) Chemical 79016 2.00E+00 Trichloroethylene ENTER ENTER **ENTER ENTER** ENTER **ENTER ENTER** ENTER ENTER ENTER Totals must add up to value of Lwt (cell G28) Soil Depth User-defined MORE Thickness Thickness stratum A Average below grade soil/ to bottom Depth Thickness of soil of soil Soil SCS stratum A soil type of enclosed etratum SCS soil vapor groundwater below grade of soil stratum 8. stratum C. OR space floor, to water table. stratum A, (Enter value or 0) (Enter value or 0) directly above soil type (used to estimate permeability, temperature. directly above soil vapor Ts LF Lwt h_A hB hc water table. k, (cm²) (°C) (cm) (cm) (cm) (cm) (cm) (Enter A, B, or C) water table permeability) 15 110 110 0 11 ENTER ENTER ENTER ENTER ENTER **ENTER** ENTER **ENTER ENTER** ENTER **ENTER ENTER** MORE Stratum B Stratum C Stratum C Stratum C Stratum C Stratum A Stratum A Stratum B Stratum B Stratum B Stratum A Stratum A SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled porosity, bulk density, bulk density, soil type porosity, soil type bulk density, porosity, porosity, soil type porosity, porosity,  $\rho_b^B$ nB θ"^B  $\rho_b^C$ nC θ_wC θ,,,  $\rho_b^A$ n^ Lookup Soll Lookup Soil Lookup Soil Parameters Parameters (g/cm³) (cm³/cm³) (g/cm³) (unitless) (cm³/cm³) (g/cm³) (unitless) (cm³/cm³) (unitless) 1.66 0.375 0.054 SL 1.80 0.330 0.103 S 1.66 0.375 0.054 S ENTER **ENTER** ENTER **ENTER** ENTER ENTER ENTER **ENTER** MORE Enclosed Enclosed Enclosed Average vapor space Soil-bldg. space space Enclosed Floor-wall Indoor flow rate into bldg. air exchange OR floor pressure floor floor space seam crack thickness, differential, width, height, width, rate, Leave blank to calculate length, Q_{soil} ΔΡ ER L_B  $W_B$ HB Lcraci (a/cm-s2) (cm) (1/h) (L/m) (cm) (cm) (cm) (cm) 1000 1000 244 0.25 10 40 0.1 MORE ENTER **ENTER ENTER ENTER** ENTER ENTER Averaging Averaging Target Target hazard time for time for Exposure Exposure risk for quotient for carcinogens, noncarcinogens, frequency. duration. carcinogens, noncarcinogens, ATc AT_{NC} ED EF TR THQ (unitless) (yrs) (yrs) (yrs) (days/yr) (unitless) 70 30 30 350 1.0E-06 Used to calculate risk-based END groundwater concentration.

Diffusivity in air, D _a (cm²/s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

	xposure uration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity, the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
	(nnn)	. L ₇	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	S _{te} (cm³/cm³)	k _i	κ _{rg}	K _v	Lcz	n _{cz}	θ _{a,cz}	θ _{w,cz}	X _{crack}
*********	(sec)	(cm)	(cm /cm )	(cm /cm )	(cm /cm )	(cm ⁻ /cm ⁻ )	(cm²)	(cm²)	. (cm²)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	(cm)
9.	46E+08	95	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
										•				
vei	Bldg. ntilation rate,	Area of enclosed space below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	Diffusion path length,
C	Q _{building}	AB	η	Z _{crack}	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	$\mu_{TS}$	D ^{eff} _A	D ^{eff} _B	D ^{eff} c	D ^{eff} cz	D ^{eff} _T	Lø
(	cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
	69E+04	4.005.00	0.775.04	1 45		5 05 5 00		1 1 70 7 6 1						
	09E+04	1.06E+06	3.77 <b>E</b> -04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	3.34E-05	95
Co	nvection	Source		Average vapor	Crack effective		Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit				
	path	vapor	Crack	flow rate	diffusion	Area of	Peclet	attenuation	bldg.	risk	Reference			
· le	ength,	conc.,	radius,	into bldg.,	coefficient,	crack,	number,	coefficient,	conc.,	factor.	conc.,			
	$L_p$	Csource	r _{crack}	$Q_{sol}$	D ^{crack}	A _{crack}	exp(Pe ^r )	α	Coulding	URF	RfC			
***************************************	(cm)	(μg/m³)	(cm)	(cm ³ /s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(µg/m³)	(μg/m³) ⁻¹	(mg/m³)	I		
	15	4.33E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	2.19E-Q5	9.48E-03	2.0E-06	6.0E-01	,		•

**RESULTS SHEET** 

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA NA	NA NA	NA	1.47E+06	NA	: ]:	7.8E-09	1.5E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.57E+02	1.32E+05	2.57E+02	1.47E+06	2.57E+02	NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

GW-ADV rsion 3.1; 02/0		K-BASED GROU	JNDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	) (X)						
151011 3. 1, 02/0	<del>"</del>	YES		٠								
Reset to		123	OR	_								
Defaults	CALCUS ATE INC	PEMENTAL DIC		CBOLINDWA.	TED CONCENTRAT	ON (anter "Y" in "YE	S" box and initial grou	ndwater conc. he	low)			
	CAECOLATE	MEMENIAL NIS	NO FROM ACTUAL	GROUNDWA	IER CONCENTRAT	ION (BINE) X III 1E	.S DOX and midal grou	nowater conc. De	low)		•	
		YES	X	7								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No.	conc.,										
	(numbers only,	Cw										
	no dashes)	(μg/L)	_		Chemical							
	79016	2.00E+00	<del>-</del> 1		T-1-51		1					
	79010	2.002+00		L	Trichloroethyle	ene	j					
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	] ENTER	ENTER	ENTER		ENTER	<u>'</u>
		Depth			ust add up to value o				Soil			
MORE	Average	below grade			Thickness	Thickness			stratum A		User-defined	
<u> </u>	soil/	to bottom	Depth	Thickness	of soil_	of soil	Soil		SCS		stratum A	
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A,	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type (used to estimate	OR	soil vapor permeability,	
	T _S	L _F	Lwr	h _A	h _B	h _c	water table,	directly above	soil vapor	OK	k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		1	(0)		1			•		1
	11	15	110	110	0	0	A	SL	SL			] .
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
<u> </u>	_l scs	soil dry	soil total	soil water-filled		soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	_porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
	Lookup Soil Parameters	$\rho_b^A$	n^	θ"^	Lookup Soil Parameters	ρ _δ ⁸	΄υ _Β	θ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Lookup Soil Parameters	ρ _ь C	n ^C	θ _w C
		(g/cm ³ )	(unitless)	(cm ³ /cm ³ )	(1000000	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )		(g/cm ³ )	(unitless)	(cm ³ /cm ³ )
	SL	1.80	0.330	0.103	s	1.66	0.375	0.054	S	1.66	0.375	0.054
				***************************************			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					,
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE.	Enclosed space	Soil-bldg.	Enclosed space	Enclosed space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bidg.			
<u> </u>	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness,	differential,	length,	width,	height,	width,	rate,	. L	eave blank to calcula	te		
	L _{crack}	ΔΡ	L _B	WB	H _B	w .	ER		Q _{soil}			
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)	i		
	10	40	1000	1000	300	0.1	0.83	1 .	5	I .		
		40	1000	1000	1 300	<u> </u>	0.63					
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
<u> </u>	Averaging	Averaging	*		Target	Target hazard						
	time for	time for	Exposure	Exposure	risk for	quotient for						
	carcinogens,	noncarcinogens AT _{NC}	, duration, ED	frequency, EF	carcinogens, TR	noncarcinogens, THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
		····					•					
	70	25	25	250	1.0E-06	1						
					Used to calcu	late risk-based						
END	]					concentration.						

in	usivity air, D _a	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, $K_{oc}$ $(cm^3/g)$	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90	E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.00				
E	ND				7,000	300.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration,	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity, $\theta_a^B$	Stratum C soil air-filled porosity, $\theta_a^{\ C}$	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability, k _i	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k _v	Thickness of capillary zone,	Total porosity in capillary zone, n _{cz}	Air-filled porosity in capillary zone, θ _{a,cz}	Water-filled porosity in capillary zone, θ _{w,cz}	Floor- wall seam perimeter, X _{crack}
	(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	(cm)
_	7.005.00	95	0.007	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
L	7.88E+08	1 95	0.227	0.321	0.321	0.220	3.94E-09	0.079	3.22E-09	25.00	1 0.55	0.010	0.020	1 4,000
	Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,rs}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, Deff (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deffect (cm²/s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
Г	6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	3.34E-05	95
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg.,  Q _{soll} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³)-1	Reference conc., RfC (mg/m³)			• .
ſ	15	4.33E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	5.36E-06	2.32E-03	1.1E-04	3.5E-02	J		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	Ī	6.3E-08	4.5E-05
					L		1 1.0E-00

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc.,	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.20E+01	4.40E+04	3.20E+01	1.47E+06	3.20E+01	NA NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

Ver	GW-ADV sion 3.1; 02/04	CALCULATE RI	SK-BASED GROU	JNDWATER CON	CENTRATION (e	enter "X" in "YES" bo	)×)						
	Reset to Defaults	CALCULATE INI	YES	OR	]								
_		CALCOLA IE IIV	CREMENTAL RISI	KS FROM ACTUA	L GROUNDWA	TER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	undwater conc. be	elow)			
			YES	X	7								
		ENTER		-	-			•					
		ENIER	ENTER										
		Chemical	groundwater										
		CAS No.	conc.,		•								
		(numbers only, no dashes)	C _w (μg/L)			<b>.</b>			•				
			(A9/2)	-		Chemical		•					
		79016	2.00E+00	]		Trichloroethyle	ene						
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	<del></del>		
	MORE	A	Depth		Totals mu	ist add up to value o	f L _{wT} (cell G28)	277127	LITTER	Soil		ENTER	
	₩ORE	Average soil/	below grade to bottom	Depth	Thistones	Thickness	Thickness			stratum A		User-defined	
		groundwater	of enclosed	below grade	Thickness of soil	of soil stratum B.	of soil stratum C	Soil		SCS		stratum A	
		temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	stratum directly above	SCS soil type	soil type (used to estimate		soil vapor	
		T _s	LF	L _{wt}	h _A	h _B	h _C	water table,	directly above	soil vapor	OR	permeability, k _v	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		11	15	110	110	0 1						(31.7.7.	
				1			0	Α	SL	SL	1		
										<u> </u>			
		ENTED	CHIPCO								<del></del>		
	MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Statum A	ENTER Stratus D	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
	MORE ¥	Stratum A SCS	ENTER Stratum A soil dry	ENTER Stratum A soil total	Stratum A	Stratum B	Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	Stratum C	Stratum C	ENTER Stratum C
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,			ENTER Stratum B soil total	ENTER Stratum B soil water-filled	ENTER Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, p _b ^	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_{w}^{\ A}$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry	ENTER Stratum B	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity,	ENTER Stratum B soil water-filled	ENTER Stratum C SCS	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^{\ C}$
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, ρ _b ^Δ (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	ENTER Stratum B soil total porosity, n ⁸ (unitless)	ENTER Stratum B soil water-filled porosity, θ, B (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS Soil type Lookup Soil Parameters	Stratum A soll dry bulk density, $\rho_b^A$ (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_{w}^{\ A}$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity, n ⁸	ENTER Stratum B soil water-filled porosity, $\theta_w^B$	ENTER Stratum C SCS Soil type Lookup Soil	Stratum C soil dry bulk density, PbC	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^{\ C}$
		Stratum A SCS soil type Lookup Soil Parameters  SL ENTER	Stratum A soil dry bulk density, ρ _b ^Δ (g/cm ³ )	Stratum A soil total porosity, n^ (unitless)	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	ENTER Stratum B soil total porosity, n ⁸ (unitless)	ENTER Stratum B soil water-filled porosity, θ, B (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
		Stratum A SCS Soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.80  ENTER	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed	Stratum A soil water-filled porosity,	Stratum B SCS Soil type Lookup Soil Parameters S ENTER	Stratum B soil dry bulk density, $\rho_b^{ B}$ (g/cm ² )  1.66	ENTER Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER	ENTER Stratum B soil water-filled porosity, θ _w ⁸ (cm³/cm³)	ENTER Stratum C SCS Soil type Lookup Soil Perameters S ENTER Average vapor	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless)	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters S ENTER Enclosed	Stratum B soil dry bulk density,  \[ \rho_b^B \\ (g/cm^3) \]  1.66  ENTER  Floor-wall	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER	ENTER Stratum B soil water-filled porosity, θ _w ⁸ (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Perameters S ENTER Average vapor flow rate into bidg.	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, \$\theta_{\text{w}}^{\text{A}}\$ (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, $\rho_b^{ B}$ (g/cm ² )  1.66	ENTER Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS Soil type Lookup Soil Perameters  S ENTER Average vapor flow rate Into bidg. OR	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  O.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, $\theta_w^A$ (cm ³ /cm ³ )  0.103  ENTER Enclosed space floor width, $W_B$	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p. 8 (g/cm³)  1.66 ENTER  Floor-wall seam crack	ENTER Stratum B soil total porosity, n ⁸ (unitless) 0.375 ENTER Indoor air exchange	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Perameters S ENTER Average vapor flow rate into bidg.	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, \$\theta_{\text{w}}^{\text{A}}\$ (cm^3/cm^3)\$  0.103  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, pb (g/cm²)  1.66  ENTER  Floor-wall seam crack width,	ENTER Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate,	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate Into bidg. OR ave blank to calculate	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  O.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, 9c, 4 (cm ³ /cm ³ ) 0.103  ENTER Enclosed space floor width, Ws (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width, \$w\$ (cm)	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE ¥	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack (cm)	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless)  O.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\text{\$\text{\$\emptyred}\$}_{\text{\$\text{\$\chi}\$}}^{\text{\$\chi}\$} (cm^{3}/cm^{3})\$  0.103  ENTER Enclosed space floor width, \$W_{B}\$ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, Pb ^B (g/cm ² )  1.66  ENTER  Floor-walt seam crack width, W (cm)	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil}	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lerack (cm)  10 ENTER	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, AP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, 9c, 4 (cm ³ /cm ³ ) 0.103  ENTER Enclosed space floor width, Ws (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER	Stratum B soil dry bulk density, p B (g/cm²)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  O.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\theta_s^A\$ (cm³/cm³) 0.103  ENTER Enclosed space floor width, \$W\$ (cm) 1000  ENTER	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, Hs (cm) 300  ENTER Target	Stratum B soil dry bulk density, pb (g/cm²)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{g}}}}^\circ\$ (cm^3/cm^3) \$\text{\$0.103}\$ \$\text{ENTER}\$ Enclosed space floor width, \$\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\te}\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\texi{\text{\text{\texi\texi{\text{\texit{\texit{\texi\text{\texi{\texi{\text{\texi\texit{\texi{\texi{\texitex{\	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, pb (g/cm²)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, 9c, 4 (cm ³ /cm ³ ) 0.103  ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS Soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width, \$w\$ (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{g}}}}^\circ\$ (cm^3/cm^3) \$\text{\$0.103}\$ \$\text{ENTER}\$ Enclosed space floor width, \$\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\te}\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\texi{\text{\text{\texi\texi{\text{\texit{\texit{\texi\text{\texi{\texi{\text{\texi\texit{\texi{\texi{\texitex{\	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p s (g/cm²)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, 9c, 4 (cm ³ /cm ³ ) 0.103  ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS Soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width, \$w\$ (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	MORE V	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_a^A\$ (cm^3/cm^3)   0.103   ENTER Enclosed space floor width, \$W_a\$ (cm)   1000   ENTER Exposure frequency, \$EF\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, Ha (cm) 300  ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm²)  1.66  ENTER  Floor-wall seam crack width, \$w\$ (cm)  0.1  ENTER  Target hazard quotient for noncarcingens, THQ (unitless)	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ, cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR ave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity, $\theta_a^B$	Stratum C soil air-filled porosity, $\theta_a^{ C}$	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability, k	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k _v	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone, θ _{acz}	Water-filled porosity in capillary zone,	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm ³ /cm ³ )	(cm)
7.88E+08	95	0.227	0.321	0.321	0.220	5.94E-09	0.879	5.22E-09	25.00	0.33	0.010	0.320	4,000
Bidg. ventilation rate, Q _{bulding} (cm ³ /s)	Area of enclosed space below grade, A ₈ (cm ² )	Crack- to-total area ratio, n (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, µts (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, Deff _T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.20E-03	0.00E+00	0.00E+00	8.83E-06	3.34E-05	95
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			:
15	4.33E+02	0.10	8.33E+01	5.20E-03	4.00E+02	8.41E+173	5.36E-06	2.32E-03	2.0E-06	6.0E-01			

## **RESULTS SHEET**

## RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	[	1.1E-09	2.7E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.76E+03	7.54E+05	1.76E+03	1.47E+06	1.76E+03	. [	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 2
AREA A WETLANDS

RESIDENTIAL

#### DATA ENTRY SHEET

GW-ADV	CALCULATE RIS	K-BASED GROUN	IDWATER CONCI	ENTRATION (e	nter "X" in "YES" bo	x)						
sion 3.1; 02/04		YES		1								
Reset to			OR	•								
Defaults	CALCULATE INC	REMENTAL RISKS	S FROM ACTUAL	GROUNDWA1	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	ndwater conc. bel	ow)			
		YES	X	]								
	ENTER	ENTER										
	ENIER	Initial										
	Chemical CAS No.	groundwater										
	(numbers only,	conc., C _w								•		
	no dashes)	(μg/L)	•		Chemical		•					
	127184	1.40E+00	]		Tetrachloroethy	lene						•
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	7
	ENTER	Depth	ENTER		ist add up to value o	of L _{wt} (cell G28)	Litter	2	Soil			
MORE ¥	Average	below grade	Dooth	Thiskness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	<b>}</b> .
	soli/ groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
	T _S	L _F	Lwt	h _A	h _B	h _c	water table,	directly above	soil vapor		k _v (cm²)	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(Citi )	1
	11	15	65	65	0	0	A	CL	CL			1
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER Streeture C	ENTER Stratum C
MORE	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
	Lookup Soil	$\rho_b^{\mathbf{A}}$	n ^A	θ., ^	Lookup Soil	ρ _b B	,n ^B	θ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Lookup Soil	$\rho_b^c$	n ^C	θ _w c
	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	CL	1.48	0.442	0.168	s	1,66	0.375	0.054	S	1.66	0.375	0.054
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE +	Enclosed space	Soil-bldg	Enclosed space	Enclosed space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bidg.			
	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness,	differential,	length,	width,	height,	width,	rate,	L	eave blank to calcula	te		
	L _{crack}	ΔP	Le	W _B	He	W (200)	ER (1/h)		Q _{soi} ; (L/m)			
	(cm)	(g/cm-s²)	(cm)	(cm)	(cm)	(cm)	( i/it)	<b>-</b> , ·	(2011)	."		
	10	40	1000	1000	244	0.1	0.25	]	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
•	Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard quotient for						
		noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
	ATC	ATNC	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)	•	-				
	70	30	30	350	1.0E-06	1						
					Head to select	ilate risk-based						
END						concentration.						
				•	Million Million							

Diffusi in air D _a (cm²/	r, in water, D _w	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.20E-	-02 8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	2.8E-01

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration,	Source- building separation, L _T	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity, $\theta_a^C$	Stratum A effective total fluid saturation, Ste	Stratum A soil intrinsic permeability, k _i	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k _v	Thickness of capillary zone,	Total porosity in capillary zone, n _{cz}	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm)
9.46E+08	50	0.274	0.321	0.321	0.245	1.26E-09	0.865	1.09E-09	46.88	0.442	0.067	0.375	4,000
Bidg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /moi)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, µrs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	9,543	8.30E-03	3.56E-01	1.76E-04	4.95E-03	0.00E+00	0.00E+00	4.97E-05	5.29E-05	50
Convection path length, L _p (cm)	Source vapor conc., C _{source} (μg/m ³ )	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg. Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	4.98E+02	0.10	8.33E+01	4.95E-03	4.00E+02	8.79E+182	6.54E-05	3.26E-02	5.9E-06	2.8E-01			

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

	Indoor exposure groundwater conc., carcingen	Indoor exposure groundwater conc., noncarcinogen	Risk-based indoor exposure groundwater conc.	Pure component water solubility, S	Final indoor exposure groundwater conc.,	Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
=	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	 (unitless)	(unitless)
	NA	NA	NA	2.00E+05	NA	7.9E-08	1.1E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen	Indoor exposure groundwater conc., noncarcinogen	Risk-based indoor exposure groundwater conc.,	Pure component water solubility, S	Final indoor exposure groundwater conc.,		Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	<b>=</b>	(unitless)	(unitless)
1.77E+01	1.26E+04	1.77E+01	2.00E+05	1.77E+01	]	NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04	CALCULATE RIS	SK-BASED GROUI	NDWATER CON	CENTRATION (e	nter "X" in "YES" bo	<b>x</b> )						
Reset to		YES	OR	]		•						
Defaults	CALCULATE INC	CREMENTAL RISK	S FROM ACTUA	L GROUNDWA	TER CONCENTRAT	ION (enter "X" in "YE	S" box and initial gro	undwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No. (numbers only,	conc., C _w										
	no dashes)	(μg/L)	-	***************************************	Chemical		r L					
	79016	1.40E+00	]		Trichloroethyle	ene						
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ist add up to value o	ENTER of Lwt (cell G28)	ENTER	ENTER	ENTER Soil	<del></del>	ENTER	]
MORE ¥	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	D-11		stratum A		User-defined	· ·
	groundwater temperature	of enclosed	below grade	of soil	stratum B,	stratum C,	Soil stratum	scs	SCS soil type		stratum A soil vapor	
	T _S	space floor, L _F	to water table, L _{wt}	stratum A, h _A	(Enter value or 0)	(Enter value or 0)	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	· (°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	65	65	0	0	Α	CL	CL	]		
												•
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum R	ENTER Stratum B	ENTER Street on B	ENTER	ENTER	ENTER	ENTER
MORE ¥	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	ENTER Stratum B soil total	ENTER Stratum B soil water-filled	ENTER Stratum C SCS	ENTER Stratum C soil dry	ENTER Stratum C soil total	Stratum C
	Stratum A	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
	Stratum A SCS soil type	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS	Stratum C soil dry bulk density, Pb C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{w}^{\ C}$
	Stratum A SCS- soil type Lookup Soil	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, P _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitiess)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
	Stratum A SCS- soil type Lookup Soil Parameters	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, Pb (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{w}^{\ C}$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb ^A (g/cm³)	Stratum A soil total porosity, n ^A (unitless)  0.442  ENTER Enclosed	Stratum A soil water-filled porosity, e _w ^ (cm³/cm³)  0.168  ENTER Enclosed	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, P _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitiess)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
	Stratum A SCS soil type Lookup Soil Parameters  CL ENTER Enclosed space	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.48  ENTER  Soil-bldg.	Stratum A soil total porosity, n^A (unitless)  0.442  ENTER Enclosed space	Stratum A soil water-filled porosity,	Stratum B SCS soli type Lookup Soil Parameters  S ENTER Enclosed	Stratum B soil dry bulk density, pb (g/cm³)  1.66  ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg.	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil parameters  CL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, PbA (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n ^A (unitless)  0.442  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, 8 % (cm³/cm³)  0.168  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Perameters	Stratum B soil dry bulk density, Pb ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters S ENTER Average vapor	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  CL ENTER Enclosed space floor thickness, L _{crack}	Stratum A soil dry bulk density, Pb ^A (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless)  0.442  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, e., A (cm³/cm³)  0.168  ENTER Enclosed space floor width, W ₈	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity, n ⁸ , (unitless)  0.375  ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S  ENTER Average vapor flow rate into bidg. OR	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil parameters  CL ENTER Enclosed space floor thickness, Lerack (cm)	Stratum A soil dry bulk density, PbA (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n ^A (unitless)  0.442  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, 8 % (cm³/cm³)  0.168  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p _b ⁸ (g/cm ³ )  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR aver blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  CL ENTER Enclosed space floor thickness, L _{crack}	Stratum A soil dry bulk density, PbA (g/cm³)  1.48  ENTER  Soil-bldg. pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless)  0.442  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, e., A (cm³/cm³)  0.168  ENTER Enclosed space floor width, W ₈	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w	Stratum B soil total porosity, n ⁸ , (unitless)  0.375  ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type  Lookup Soil Parameters  CL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, ew (cm³/cm³) 0.168  ENTER Enclosed space floor width, W8 (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, He (cm) 244 ENTER	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE \$\psi\$	Stratum A SCS soil type Lookup Soil Parameters  CL ENTER Enclosed space floor thickness, Lorack (cm)	Stratum A soil dry bulk density, p. A (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled prossition, 4 (cm³/cm³) 0.168  ENTER Enclosed space floor width, W8 (cm)  1000  ENTER	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type  Lookup Soil Parameters  CL  ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\theta_w^{}\$ (cm^3/cm^3)\$  0.168  ENTER Enclosed space floor width, \$                                                                                                                                                                                                                      \tex	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil parameters  CL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porositiv, e, ', (cm³/cm³).  0.168  ENTER Enclosed space floor width, W ₈ (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p B (g/cm³)  1.66 I ENTER Floor-wall seam crack width, w (cm)  0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS - Soil type  Lookup Soil parameters  CL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, ATNC (yrs)	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, La (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_{*}^{A}\$ (cm^3/cm^3)\$  0.168  ENTER Enclosed space floor width, \$W_8\$ (cm)  1000  ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  CL ENTER Enclosed space floor thickness, Lerack (cm)  10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, e, ', (cm³/cm³).  0.168  ENTER Enclosed space floor width, W ₈ (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p B (g/cm³)  1.66 I ENTER Floor-wall seam crack width, w (cm)  0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$
MORE	Stratum A SCS - Soil type  Lookup Soil parameters  CL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.48  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, ATNC (yrs)	Stratum A soil total porosity, n^ (unitless)  0.442  ENTER Enclosed space floor length, La (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_{*}^{A}\$ (cm^3/cm^3)\$  0.168  ENTER Enclosed space floor width, \$W_8\$ (cm)  1000  ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)  1 ate risk-based	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e, s (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{\ C}$ $(cm^3/cm^3)$

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration,	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity, $\theta_a^B$	Stratum C soil air-filled porosity, $\theta_a^c$	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability, k _i	Stratum A soil relative air permeability, k _{ra}	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone, $\theta_{acz}$	Water-filled porosity in capillary zone, θ _{w.cz}	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm ³ /cm ³ )	(cm²)	(cm²)	(cm²)	L _{cz} (cm)	n _{cz} (cm³/cm³)	(cm³/cm³)	(cm³/cm³)	^crack (cm)
						<u> </u>			(0)				\( \)
9.46E+08	50	0.274	0.321	0.321	0.245	1.26E-09	0.865	1.09E-09	46.88	0.442	0.067	0.375	4,000
Bldg. ventilation	Area of enclosed space below	Crack- to-total area	Crack depth below	Enthalpy of vaporization at ave. groundwater	Henry's law constant at ave. groundwater	Henry's law constant at ave. groundwater	Vapor viscosity at ave. soil	Stratum A effective diffusion	Stratum B effective diffusion	Stratum C effective diffusion	Capillary zone effective diffusion	Total overall effective diffusion	Diffusion path
rate,	grade,	ratio,	grade,	temperature,	temperature,	temperature,	temperature,	coefficient,	coefficient,	coefficient,	coefficient,	coefficient,	length,
Q _{building}	A _B	η	Z _{crack}	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	μτς	Deff	De [#] B	Delc	D ^{eff} cz	D ^{eff} _T	La
(cm ³ /s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.43E-03	0.00E+00	0.00E+00	5.78E-05	6.16E-05	50
Convection	Source		Average vapor	Crack effective		Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit				
path	vapor	Crack	flow rate	diffusion	Area of	Peclet	attenuation	bldg.	risk	Reference			
length,	conc.,	radius,	into bldg.,	coefficient,	crack,	number,	coefficient,	conc.,	factor,	conc.,			
L _p	C _{source}	r _{crack}	$Q_{soil}$	D ^{crack}	A _{crack}	exp(Pe ^r )	α	C _{building}	URF	RfC			
(cm)	(μg/m³)	(cm)	(cm³/s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(μg/m³)	(μg/m³) ⁻¹	(mg/m³)			
15	3.03E+02	0.10	8.33E+01	5.43E-03	4.00E+02	5.33E+166	7.59E-05	2.30E-02	1.1E-04	3.5E-02	]		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	1.0E-06	6.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc.,	Pure component water solubility, S	Final indoor exposure groundwater conc.,	ris V intru ind card	emental k from apor usion to oor air, cinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
1.35E+00	2.22E+03	(mg/L) 1.35E+00	(mg/L) 1.47E+06	(mg/L) 1.35E+00		nitless) NA	(unitless)

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

GW-ADV ersion 3.1; 02/04	CALCULATE RIS	K-BASED GROUN	NOWATER CONC	ENTRATION (en	ter "X" in "YES" box	<b>x</b> )						
		YES		]								. •
Reset to Defaults	CALCULATE INC	DEMENTAL DISK	OR S EPOM ACTUAL	CPOLINDWÁT	ED CONCENTRATI	ON (enter "Y" in "YE	S" box and initial grou	ndwater conc. hel	low)			
	CALCULATE INC	REWENTAL RISK		- GROUNDWAI	ER CONCENTRATI	Old (elite) X III 1E	S box and initial grou	nuwater conc. bei	iow)			
		YES	X	]								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
												•
	79016	1.40E+00	}	L.,	Trichloroethyle	ene						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	].
MORE	Average	Depth below grade		Totals mu	st add up to value o Thickness	f L _{w1} (cell G28) Thickness			Soil stratum A		User-defined	
₩ OKE	soil/	to bottom	Depth	Thickness	of soil	of soil	Soil		SCS		stratum A	
	groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	İ
	temperature, T _S	space floor, L _F	to water table, L _{w1}	stratum A, h _A	(Enter value or 0)	(Enter value or 0) h _C	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
					0	0		T CL	CL			
	11	15	65	65		<u> </u>	Α	1	<u> </u>	····	L	
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
<u> </u>	scs	soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled
	Soil type  Lookup Soil	bulk density, Pb ^A	porosity, n ^A	porosity, θ _w ^A	soil type	bulk density, ρ _ь 8	porosity, ກຸ ^B	porosity, θ _w ^B	soil type	bulk density, ρ _в с	porosity n ^C	porosity. θ _w C
	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm ³ )	(unitless)	(cm³/cm³)
												0.054
	CL	1.48	0.442	0.168	8	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
1170KE	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		flow rate into bldg.			
	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness, L _{creck}	differential, ΔP	length, L _B	width, W _B	height, H _B	width, w	rate, ER	L	eave blank to calculat Q _{soil}	.e		
	(cm)	(g/cm-s²)	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)			•
	10	40	1000	1000	244	0.1	0.25	- 1	5			
		•					0.25	_	L			
MORE ↓	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard						
	time for	time for	Exposure	Exposure	risk for	quotient for						
	carcinogens,	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
	AT _C (yrs)	AT _{NC} (yrs)	ED (yrs)	EF (days/yr)	TR (unitless)	THQ (unitless)						
	70	30	30	350	1.0E-06	1		1 2				
END						late risk-based						

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_e^B$ $(cm^3/cm^3)$	Stratum C soil air-filled porosity, θ _a ^C (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k, (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm ² )	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, θ _{w,cz} (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
9.46E+08	50	0.274	0.321	0.321	0.245	1.26E-09	0.865	1.09E-09	46.88	0.442	0.067	0.375	4,000
Bidg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, µts (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.43E-03	0.00E+00	0.00E+00	5.78E-05	6.16E-05	50
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	3.03E+02	0.10	8.33E+01	5.43E-03	4.00E+02	5.33E+166	7.59E-05	2.30E-02	2.0E-06	6.0E-01	İ		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	1.9E-08	3.7E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.41E+01	3.81E+04	7.41E+01	1.47E+06	7.41E+01	. [	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

#### DATA ENTRY SHEET

	V-ADV	CALCULATE RIS	K-BASED GROU	INDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	x)						
rsion	3.1; 02/04				1								
Ρ.	set to		YES	L	1								
	efaults			OR	00000000000		2011 /	Of hair and initial annual					
		CALCULATE INC	REMENIAL RIS	KS FROM ACTUAL	GROUNDWA	IER CONCENTRAT	ION (enter "X" in "YE	S" box and initial groui	nawater conc. bei	ow)			
			YES	Х	1							-	
					•								
		ENTER	ENTER										
		Chemical	Initial groundwater			* *							
		CAS No.	conc.,					*					
		(numbers only,	Cw										
		no dashes)	(μg/L)	_		Chemical	·····						
		127184	1.40E+00	7		Tetrachloroethy	/lene	! ·					
				ــا	<del></del>								_
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	]
			Depth		Totals mi	ust add up to value o				Soil			
	MORE	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
		groundwater	of enclosed	below grade	of soil	stratum B.	stratum C,	stratum	scs	soil type		soil vapor	
		temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above	soil type	(used to estimate	OR	permeability,	
		Ts	L _F	Lwt	h _A	` h _B	h _c	water table,	directly above	soil vapor		k,	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		11	15	65	65	0	0	Α	CL	Cr			J
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
	MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
	<b>4</b>	SCS	soil dry	soil total	soil water-filled		soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled
		soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
		Lookup Soil Parameters	ρ ₆ ^A .	n ^A	θ^	Lookup Soil Parameters	ρь ^B	n ^B	6″ _B	Lookup Soil Parameters	ρ _ν ς	n ^C	θ <b>"</b> C
		Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Talameters	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )
		CL	1.48	0.442	0.168	S	1.66	0.375	0.054	s	1.66	0.375	0.054
		<u></u>			10.100								
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
	MORE .	Enclosed	Soil-bldg.	Enclosed space	Enclosed	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bldg.			
		space	pressure	floor	space floor	space	seam crack	air exchange		OR			
		thickness,	differential,	length,	width,	height,	width,	rate,	L	eave blank to calcula	ite		
		L _{crack}	ΔΡ	LB	WB	H _B	w	ER		Q _{soil}			
	٠ .	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	•	(L/m)			
				7	1				-		1		
		10	40	1000	1000	300	0,1	0.83	J	5	l .		
	MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER				• .		
	<u> </u>	Averaging	Averaging			Target	Target hazard						
		time for	time for	Exposure	Exposure	risk for	quotient for						
		carcinogens,	noncarcinogens	, duration, ED	frequency, EF	carcinogens, TR	noncarcinogens, THQ						
		AT _C (yrs)	AT _{NC} (yrs)	(yrs)	(days/yr)	(unitiess)	(unitless)						
		(913)	(319)	71,21	(daysiyi)	(dinacco)	(01111000)						
		70	25	25	250	1.0E-06	1						
				· ·			data dalah seser						
	END						late risk-based concentration.						
	CIAD					<u> </u>	CONCORREGION.						

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point,	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.20E-02	9 20E 06	4 045 00	05 1							
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	2.8E-01

Exposure duration, τ	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity, $\theta_a^B$	Stratum C soil air-filled porosity, $\theta_a^{\ C}$	Stratum A effective total fluid saturation, S _{te}	Stratum A soil intrinsic permeability, k _i	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k _v	Thickness of capillary zone,	Total porosity in capillary zone, n _{cz}	Air-filled porosity in capillary zone, θ _{a,cz}	Water-filled porosity in capillary zone, θ _{w,cz}	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
7.88E+08	50	0.274	0.321	0.321	0.245	1.26E-09	0.865	1.09E-09	46.88	0.442	0.067	0.375	4,000
Bidg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	9,543	8.30E-03	3.56E-01	1.76E-04	4.95E-03	0.00E+00	0.00E+00	4.97E-05	5.29E-05	50
Convection path length,	Source vapor conc., C _{source} (µg/m³)	Crack radius, ^r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³)·1	Reference conc., RfC (mg/m³)			
15	4.98E+02	0.10	8.33E+01	4.95E-03	4.00E+02	8.79E+182	1.60E-05	7.98E-03	5.9E-06	2.8E-01	]		

**RESULTS SHEET** 

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure	Indoor exposure	Risk-based indoor	Pure component	Final indoor	Incremental Hazard risk from quotient vapor from vapor
groundwater conc., carcinogen (μg/L)	groundwater conc., noncarcinogen (μg/L)	exposure groundwater conc., (µg/L)	water solubility, S (μg/L)	exposure groundwater conc., (µg/L)	intrusion to intrusion to indoor air, indoor air, carcinogen noncarcinogen (unitless)
NA	NA NA	NA	2.00E+05	NA	1.2E-08 2.0E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

### **INCREMENTAL RISK CALCULATIONS:**

groundwater groundwater conc., conc., carcinogen noncarcinogen (mg/L) (mg/L)	exposure groundwater conc., (mg/L)	component water solubility, S (mg/L)	indoor exposure groundwater conc., (mg/L)	vapor intrusion to indoor air, carcinogen (unitless)	from vapor intrusion to indoor air, noncarcinogen (unitless)
------------------------------------------------------------------------------	---------------------------------------------	--------------------------------------	-------------------------------------------------------	------------------------------------------------------------------	--------------------------------------------------------------------------

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

GW-ADV	CALCULATE R	ISK-BASED GROU	INDWATER CONC	CENTRATION (e	nter "X" in "YES" b	ox)						
ersion 3.1; 02/04		YES		7								
Reset to Defaults			OR	<b></b>								
Jointo	CALCULATE IN	ICREMENTAL RISI	KS FROM ACTUA	L GROUNDWAT	ER CONCENTRA	TION (enter "X" in "YE	S" box and initial grou	undwater conc. be	elow)			
		YES	X	]								
•	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No. (numbers only,	conc., C _w										
	no dashes)	(μg/ <b>L</b> )	_	**************	Chemical		•					
	79016	1.40E+00	].		Trichloroethyl	ene						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	1
MORE	Average	Depth below grade		Totals mu	st add up to value Thickness	of L _{wt} (cell G28) Thickness			Soil stratum A		User-defined	
<u> </u>	soil/	to bottom	Depth	Thickness	of soil	of soil	Soil		scs		stratum A	}
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A,	stratum B. (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type	0.0	soil vapor	
	Ts	L _F	L _{wt}	h _A	h _B	h _C	water table,	directly above	(used to estimate soil vapor	OR	permeability, k _v	ł
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	65	65	0	0	A	CL	CL		F	
	-			***************************************					<u> </u>		<del></del>	1
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE .	Stratum A SCS	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
	soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	Lookup Soil	PbA	n ^A	θ,,,	Lookup Soil	ρ _b ^B	n ^B	θ _w ^B	Lookup Soil	ρ _b C	n ^C	$\theta_{\mathbf{w}}^{C}$
	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	CL_	1.48	0.442	0.168	S	1.66	0.375	0.054	s I	1.66	0.375	0.054
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE	Enclosed		Enclosed	Enclosed	<b>2</b> (1)	LIVILA	LNIEN		Average vapor			
<u> </u>	space floor	Soil-bldg. pressure	space floor	space	Enclosed	Floor-wall	Indoor		flow rate into bldg.			
	thickness,	differential,	length,	floor width,	space height,	seam crack width,	air exchange rate,	f o	OR eave blank to calculat			
	L _{crack}	ΔΡ	Le	WB	Нв	w	ER	_,	Q _{soil}	•		
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	•	(L/m)			
	10	40	1000	1000	300	0.1	0.83	]	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
	Averaging time for	Averaging	Evenenue	Sum alasses	Target	Target hazard						
	carcinogens,	time for noncarcinogens,	Exposure duration,	Exposure frequency,	risk for carcinogens,	quotient for noncarcinogens,						
	ATc	AT _{NC}	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	25	25	250	1.0E-06	1			•			
					Used to calcu	late risk-based						
END				1		concentration.						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm²/s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposure duration, τ	Source- building separation, L _T	Stratum A soil air-filled porosity, $\theta_a^A$	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity, e _a c	Stratum A effective total fluid saturation, Ste	Stratum A soil intrinsic permeability, k	Stratum A soil relative air permeability, k _{rg}	Stratum A soil effective vapor permeability, k,	Thickness of capillary zone,	Total porosity in capillary zone, n _{cz}	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm)
7.88E+08	50	0.274	0.321	0.321	0.245	1.26E-09	0.865	1.09E-09	46.88	0.442	0.067	0.375	4,000
											<u> </u>		1,1222
Bidg. ventilation rate,	Area of enclosed space below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave, groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	Diffusion path length.
Q _{building}	A _B	η	Z _{crack}	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	$\mu_{TS}$	Deff	D ^{eff} B	D ^{eff} c	D ^{eff} cz	D ^{eff} _T	$L_d$
(cm ³ /s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	. (cm²/s)	(cm²/s)	(cm²/s)	(cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	5.43E-03	0.00E+00	0.00E+00	5.78E-05	6.16E-05	50
Convection path	Source vapor	Crack	Average vapor flow rate	Crack effective diffusion	Area of	Exponent of equivalent foundation Peclet	Infinite source indoor	Infinite source	Unit	Deference			
length,	conc.,	radius.	into bldg.,	coefficient,	crack,	number,	attenuation coefficient.	bidg. conc.,	risk factor.	Reference conc.,	•		
L _p	C _{source}	r _{crack}	$Q_{soil}$	D ^{crack}	A _{crack}	exp(Pe ^f )	α	C _{building}	URF	RfC			•
(cm)	(μg/m³)	(cm)	(cm ³ /s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(µg/m³)	(μg/m³) ⁻¹	(mg/m³)			
15	3.03E+02	0.10	8.33E+01	5.43E-03	4.00E+02	5.33E+166	1.86E-05	5.63E-03	1.1E-04	3.5E-02	· }		

# **RESULTS SHEET**

# RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

### **INCREMENTAL RISK CALCULATIONS:**

Indoor	Indoor	Risk-based	Pure	Final	Incremental risk from	Hazard quotient
exposure	exposure	indoor	component	indoor	vapor	from vapor
groundwater conc.,	groundwater conc.,	exposure groundwater	water solubility,	exposure groundwater	intrusion to indoor air,	intrusion to indoor air,
carcinogen (μg/L)	noncarcinogen (μg/L)	conc., (μg/L)	S (μg/L)	conc., (μg/L)	carcinogen (unitless)	noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	 1.5E-07	1.1E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
9.24E+00	1.27E+04	9.24E+00	1.47E+06	9.24E+00	[	NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV	CALCULATE RIS	K-BASED GROUN	DWATER CONCE	ENTRATION (e	nter "X" in "YES" bo	x)						
Reset to		YES	OD	]								
Defaults	CALCULATE INC	CREMENTAL RISKS	OR S FROM ACTUAL	GROUNDWAT	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial groun	ndwater conc. be	iow)			
		YES	Х	]								
	ENTER	ENTER										
		Initial groundwater										
	Chemical CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
	79016	1.40E+00			Trichloroethyle	ene	I					•
		1	ļ								FAITE	
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER st add up to value o	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE .	Average	below grade	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	*
	soil/ groundwater	to bottom of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	T _s (℃)	L _F (cm)	L _{W1} (cm)	h _A . (cm)	h _e (cm)	h _C (cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		(CIII)										
*	11	15	65	65	0	0	Α	CL	ĊL	l	L	J
						ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
<u>+</u>	SCS	soil dry		soil water-filled	scs	soil dry	soil total	soil water-filled		soil dry	soli total	soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity, n ⁸	porosity, θ _w ^B	Soil type  Lookup Soil	bulk density, ρ _ε c	porosity, n ^C	porosity, θ _w ^C
	Lookup Soil Parameters	ρ _ь ^ (g/cm³)	n ^A (unitless)	θ _w ^A (cm³/cm³)	Lookup Soil Parameters	ρ _ь ^B (g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm ³ )	(unitless)	(cm³/cm³)
												0.054
	CL	1.48	0.442	0.168	S	1.66	0.375	0.054	<u> </u>	1.66	0.375	1 0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
Ψ	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		flow rate into bidg. OR			
	floor thickness,	pressure differential,	floor length,	floor width,	space height,	seam crack width,	air exchange rate,	L	eave blank to calcula	ate		
	L _{crack}	ΔΡ	L _B	Wa	He	w	ER		Q _{soil}			
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)	•		
	10	40	1000	1000	300	0.1	0.83	]	5	]		
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
	Averaging	Averaging	Exposure	Evocure	Target risk for	Target hazard quotient for						
	time for carcinogens,	time for noncarcinogens,	Exposure duration,	Exposure frequency,	carcinogens,	noncarcinogens,						
	ATc	AT _{NC}	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)	•					
	70	25	25	250	1.0E-06	1						
						ulate risk-based						
END					groundwater	concentration.	]					

# CHEMICAL PROPERTIES SHEET

	Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7	.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

	zone, zone, perimeter,
$ au$ L _T $ heta_a^A$ $ heta_a^B$ $ heta_a^C$ S _{1e} k ₁ k ₇₀ k ₂ L _{cz} $ extstyle  heta_{cz}$	$\theta_{a,cz}$ $\theta_{w,cz}$ $X_{crack}$
(sec) (cm) $(cm^3/cm^3)$ $(cm^3/cm^3)$ $(cm^3/cm^3)$ $(cm^3/cm^3)$ $(cm^2)$ $(cm^2)$ $(cm^2)$ $(cm)$ $(cm)$ $(cm)$	(cm ³ /cm ³ ) (cm ³ /cm ³ ) (cm)
7.88E+08 50 0.274 0.321 0.321 0.245 1.26E-09 0.865 1.09E-09 46.88 0.442	0.067 0.375 4,000
enclosed Crack- Crack Enthalpy of Henry's law Henry's law Vapor A B C Bldg. space to-total depth vaporization at constant at constant at viscosity at effective effective effective e ventilation below area below ave. groundwater ave. groundwater ave. groundwater ave. soil diffusion diffusion d rate, grade, ratio, grade, temperature, temperature, temperature, temperature, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficie	Capillary Total zone overall effective effective Diffusion diffusion diffusion path coefficient, coefficient, length,
$Q_{ ext{building}}$ $A_{ heta}$ $\eta$ $Z_{ ext{crack}}$ $\Delta H_{ ext{v,TS}}$ $H_{ ext{TS}}$ $H'_{ ext{TS}}$ $H'_{ ext{TS}}$ $\mu_{ ext{TS}}$ $D^{ ext{eff}}$ $D^{ ext{eff}}$	$D^{eff}_{cz}$ $D^{eff}_{T}$ $L_d$
$(cm^3/s)$ $(cm^2)$ $(unitless)$ $(cm)$ $(cal/mol)$ $(atm-m^3/mol)$ $(unitless)$ $(g/cm-s)$ $(cm^2/s)$ $(cm^2/s)$ $(cm^2/s)$	(cm ² /s) (cm ² /s) (cm)
6.92E+04 1.06E+06 3.77E-04 15 8,544 5.05E-03 2.17E-01 1.76E-04 5.43E-03 0.00E+00 0.00E+00 5	5.78E-05 6.16E-05 50
Exponent of Infinite  Average Crack equivalent source Infinite  Convection Source vapor effective foundation indoor source Unit	
path vapor Crack flow rate diffusion Area of Peclet attenuation bldg. risk Reference	
length, conc., radius, into bldg., coefficient, crack, number, coefficient, conc., factor, conc.,	
$L_p$ $C_source$ $r_crack$ $Q_soil$ $D^crack$ $A_crack$ $exp(Pe^f)$ $\alpha$ $C_building$ URF RfC	
(cm) ( $\mu$ g/m³) (cm) (cm³/s) (cm²/s) (cm²) (unitless) ( $\mu$ g/m³) ( $\mu$ g/m³) (mg/m³)	
15 3.03E+02 0.10 8.33E+01 5.43E-03 4.00E+02 5.33E+166 1.86E-05 5.63E-03 2.0E-06 6.0E-01	

# RESULTS SHEET

# RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	2.8E-09	6.4E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.08E+02	2.18E+05	5.08E+02	1.47E+06	5.08E+02	]	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 3

RESIDENTIAL

#### DATA ENTRY SHEET

W-ADV	CALCULATE R	ISK-BASED GROU	NOWATER CONC	ENTRATION (e	nter "X" in "YES" bo	ox)						
on 3.1; 02/04				-								
Reset to		YES	L	J								
Defaults			OR									
Delaults	CALCULATE IN	ICREMENTAL RISH	KS FROM ACTUAL	. GROUNDWA	TER CONCENTRAT	TON (enter "X" in "YE	S" box and initial grou	ndwater conc. be	elow)			
		VEC	□ X	٠ .								
		YES		J								
	ENTER	ENTER										
		Initial										
	Chemical	groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Charaters.							
	no dasnes)	(μg/ε/			Chemical		•					
	67663	1.50E+01	٦	<u> </u>	Chloroform		•					
		. I.,	J		O THO TO TO THE			7	•			
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	7
		Depth		Totals mu	st add up to value o				Soil			
MORE	Average	below grade			Thickness	Thickness	-		stratum A		User-defined	
•	soil/	to bottom	Depth	Thickness	of soil	of soil	Soil		SCS		stratum A	
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A,	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum	SCS	soil type		soil vapor	1
	Ts	L _F	L _{wT}	h _A	. h _B	h _c	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
							12	Water table	Doint Cability/	•	(0.11)	1
	11	15	110	110	0	0	A	S	S			1
									,			-
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
<u> </u>	SCS	soil dry		soil water-filled		soil dry	soil total	soil water-filled		soil dry	soil total	soil water-filled
	soil type	bulk density,	porosity,	porosity	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity.	porosity,
	Lookup Soil Parameters	ρ _δ	n ^A	θ"^	Lookup Soil Parameters	$\rho_b^B$	n ^B	θ _w ⁸	Lookup Soil	Pb ^C	n ^c	. θ <b>"</b> C
		(g/cm ³ )	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	S	1.80	0.330	0.054	S	1.66	0.375	0.054	T s	100		
	<u></u>	1.00	0.000	0.034	3	1,00	0.375	0.054	1 8	1.66	0.375	0.054
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE	Enclosed		Enclosed	Enclosed	_				Average vapor			
	space floor	Soil-bldg. pressure	space floor	space floor	Enclosed	Floor-wall	Indoor		flow rate into bldg.			
	thickness.	differential,	length,	width,	space height,	seam crack width,	air exchange rate,	1	OR eave blank to calcula.	10		
	L _{crack}	ΔΡ	L _B	W _B	H _B	w	ER	•	Q _{soil}			
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)			
	10	40	1000	1000	244	0.1	0.25		5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
Ψ	Averaging	Averaging			Target	Target hazard						
	time for	time for	Exposure	Exposure	risk for	quotient for						
	carcinogens,	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
	AT _C	AT _{NC}	ED (ven)	EF (dougle)	TR	THQ	•					
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	30	30	350	1.0E-06	1						
END						late risk-based						
ENU				į	groundwater	concentration.						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m ³ )
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

Exposure duration, τ (sec)	Source- building separation, L ₁ (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^{\ B}$ (cm³/cm³)	Stratum C soil air-filled porosity, θ _a ^C (cm ³ /cm ³ )	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm ² )	Thickness of capillary zone,  L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
9.46E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} A (cm²/s)	Stratum B effective diffusion coefficient, Deff ₈ (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	1.31E-02	0.00E+00	0.00E+00	1.96E-04	1.02E-03	95
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soi} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe ^t ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	1.26E+03	0.10	8.33E+01	1.31E-02	4.00E+02	8.21E+68	5.93E-04、	7.46E-01	2.3E-05	4.9E-02			•

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen	Indoor exposure groundwater conc., noncarcinogen	Risk-based indoor exposure groundwater conc.,	Pure component water solubility, S	Final indoor exposure groundwater conc.,	Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
(μg/L)	μg/L)	(μg/L)	(μg/L)	conc., (μg/L)	(unitless)	(unitless)
NA	NA	NA	7.92E+06	NA	7.0E-06	1.5E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.13E+00	1.03E+03	2.13E+00	7.92E+06	2.13E+00	- [	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

	/-ADV	CALCULATE RIS	SK-BASED GROU	NDWATER CONC	ENTRATION (er	nter "X" in "YES" bo	x)						
ersion	3.1; 02/04				-								
			YES	L	J								
	set to			OR									
De	faults	CALCULATE IN	CREMENTAL RISK	S FROM ACTUAL	_ GROUNDWAT	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	low)			
			VEC	X	7								
			YES		J .								
		ENTER	ENTER										
			Initial										
		Chemical	groundwater										
		CAS No.	conc.,										
		(numbers only, no dashes)	C _w (μg/L)			Chemical							
		79016	7.00E+00	1		Trichloroethyle	ene						
				-									_
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	
			Depth		Totals mu	st add up to value o				Soil stratum A		User-defined	l
	MORE .	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		SCS		stratum A	
*	<u> </u>	groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
		temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
		Ts	L _f	L _{W7}	h _A	h _B	h _C	water table,	directly above	soil vapor		k _v	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	_
		11	15	110	110	0	0	Α	s	Š			4
		<u> </u>	19	1 110	1 110							<u> </u>	_1
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
	MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
		SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
		Lookup Soil	ρ _b ^A	n ^A	θ*	Lookup Soil	ρ _b ^B	n ^B	θ,,,	Lookup Soil	ρ _b C	nc	θ _w ^C
		Parameters	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )
			(9/0/	(cittless)	(0)		(3.5)	(0)311000/	\\				
		S	1.80	0.330	0.054	S	1.66	0.375	0.054	\$	1.66	0.375	0.054
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
	MORE	Enclosed	ENIER	Enclosed	Enclosed	ENTER	ENIER	LINIER		Average vapor			
	₩ ¥	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		flow rate into bldg.			
		floor	pressure	floor	floor	space	seam crack	air exchange		OR			
		thickness,	differential, ΔP	length,	width,	height,	width,	rate, ER	L	eave blank to calcula. Q _{soll}	te		
		Lcrack	_	· L _B	W ₈	H _B	W (2007)						
		(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	=	(L/m)			
		10	40	1000	1000	244	0.1	0.25	7	5			
									_				
	MORE .	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER Target begand						
		Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard quotient for						
		carcinogens,	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
				ED	EF	TR	THQ			· .			
		. AT _C	AT _{NC}		<u></u> 1								
		(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
		(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)							
							(unitless)						
		(yrs)	(yrs)	(yrs)	(days/yr)	(unitless) 1.0E-06							
	END	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)  1.0E-06  Used to calcu	1						

# CHEMICAL PROPERTIES SHEET

Diffusivi in air, D _a (cm ² /s)	in water, D _w	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-0	2 9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	θ _a ^	θ ₈ ^B	$\theta_a^c$	S _{te}	K _i	k _{rg}	κ _ν	L _{cz}	n _{cz}	θ _{a,c2}	θ _{w,cz}	X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm ² )	(cm²)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	(cm)
9.46E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
Bldg. ventilation rate, Q _{bullding} (cm ³ /s)	Area of enclosed space below grade, A ₈ (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature,  ΔH _{v,Ts} (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} {atm-m ³ /mol}	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum  A effective diffusion coefficient, Deff (cm²/s)	Stratum B effective diffusion coefficient, Deffs (cm²/s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deff_cz (cm²/s)	Total overall effective diffusion coefficient, Deff (cm²/s)	Diffusion path length, L _d (cm)
										1 0005.00	1 4 455 04	7.555.04	7
1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.97E-03	0.00E+00	0.00E+00	1.45E-04	7.55E-04	95
Convection path	Source vapor	Crack	Average vapor flow rate	Crack effective diffusion	Area of	Exponent of equivalent foundation Peclet	Infinite source indoor attenuation	Infinite source bldg.	Unit risk	Reference	•		
length,	conc.,	radius,	into bldg.,	coefficient,	crack,	number,	coefficient,	conc.,	factor,	conc.,			
L _p	C _{source}	r _{crack}	Q _{soil}	D ^{crack}	A _{crack}	exp(Pe ^f )	α	C _{building}	URF	RfC			
(cm)	(μg/m³)	(cm)	(cm ³ /s)	(cm²/s)	(cm²)	(unitless)	(unitless)	(μg/m³)	(μg/m³) ⁻¹	(mg/m³)			*
15	1.52E+03	0.10	8.33E+01	9.97E-03	4.00E+02	5.28E+90	4.52E-04	6.85E-01	1.1E-04	3.5E-02	] .		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	·	3.1E-05	1.9E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

**PRG SHEET** 

# RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		risk from vapor intrusion to indoor air, carcinogen (unitless)	quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.26E-01	3.73E+02	2.26E-01	1.47E+06	2.26E-01	: ]	NA NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

	V-ADV	CALCULATE RIS	SK-BASED GROU	INDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	ox)						
	9 3.1; 02/04 eset to		YES	OR	]								
De	efaults	CALCULATE INC	CREMENTAL RISI		GROUNDWAT	TER CONCENTRAT	TON (enter "X" in "YE	S" box and initial grou	indwater conc. be	iow)			
			YES	Х	]								
		ENTER	ENTER		:								
		Chemical	Initial groundwater										
		CAS No. (numbers only,	conc., C _w								*		
		no dashes)	(μg/L)	_		Chemical		-					
		79016	7.00E+00	]		Trichloroethyle	ene	]					
		ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER	ENTER	ENTER	ENTER	ENTER Soil		ENTER	1.
	MORE ↓	Average soil/ groundwater	below grade to bottom of enclosed	Depth below grade	Thickness of soil	Thickness of soil stratum B,	Thickness of soil stratum C,	Soil stratum	scs	stratum A SCS soil type		User-defined stratum A	
		temperature, T _S	space floor, L _f	to water table, L _{wt}	stratum A, h _A	(Enter value or 0)	(Enter value or 0) h _C	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	soil vapor permeability, k,	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		11	15	110	110	0	0	A	S	S			]
	MORE 🔶	ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	ENTER Stratum A soil total porosity, n^ (unitless)	ENTER Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ _b ^B (g/cm ³ )	ENTER Stratum B soil total porosity, n ^B (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, $\rho_b^C$ (g/cm³)	ENTER Stratum C soil total porosity, n ^C (unitless)	ENTER Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
		S	1.80	0.330	0.054	S	1.66	0.375	0.054	s	1.66	0.375	0.054
	MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor		0.0.0	0.004
		space floor	Soil-bldg. pressure	space floor	space floor	Enclosed space	Floor-wall seam crack	Indoor air exchange		flow rate into bidg. OR			
		thickness, L _{crack}	differential, ΔP	length, L _B	width, W _B	height, H _B	width, w	rate, ER	L	eave blank to calcula Q _{soil}	te		
		(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	<u>.</u>	(L/m)			
		10	40	1000	1000	244	0.1	0.25	]	5			
	MORE .	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard						
		time for carcinogens,	time for noncarcinogens,	Exposure duration	Exposure frequency,	risk for carcinogens,	quotient for noncarcinogens,						
		AT _C (yrs)	AT _{NC} (yrs)	ED (yrs)	EF (days/yr)	TR (unitless)	THQ (unitless)						
		70	30	30	350	1.0E-06	1	· . 					
	END					Used to calcu	late risk-based						
						giodilowaldi.	Jon Jon Haudin.	· ·					

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

Sec   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm   (cm		Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
9.46E+08   95   0.276   0.321   0.321   0.004   9.94E-08   0.998   9.92E-08   17.05   0.33   0.077   0.253   4.000		τ	LŢ	$\theta_a^{\Lambda}$	$\theta_a^{B}$	$\theta_{\mathbf{a}}^{\mathbf{C}}$	S _{te}	k,	k _{rg}	k,	L _{cz}		$\theta_{a,cz}$	$\theta_{w,cz}$	X _{crack}
Area of enclosed Crack Crack Enthalpy of enclosed below area below area below area personation at constant at constant at emperature, constant at emperature, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, co	-	(sec)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
Area of enclosed Crack Crack Enthalpy of enclosed below area below area below area personation at constant at constant at emperature, constant at emperature, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, coefficient, co	Γ-	9.46E±08	05	0.276	0.331	0.221	0.004	0.045.00	0.000	L 0.00F.00	47.05	0.00			1
Bidg. space to-total depth vaporization at set, grade, ratio, grade, (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s)	_	3.40E100	. 33	. 0.270	0.321	0.321	0.004	9.946-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
(cm³/s)         (cm²)         (unitless)         (cm)         (cal/mol)         (atm-m³/mol)         (unitless)         (g/cm-s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)		ventilation	enclosed space below	to-total area	depth below	vaporization at ave. groundwater	constant at ave. groundwater	constant at ave. groundwater	viscosity at ave. soil	A effective diffusion	B effective diffusion	C effective diffusion	zone effective diffusion	overall effective diffusion	path
Cm ³ /s   (cm ² )   (unitless)   (cm)   (cal/mol)   (atm-m³/mol)   (unitless)   (g/cm-s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (c		Quilding	AB	η	$Z_{crack}$	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	$\mu_{TS}$	D ^{eff} _A	D ^{eff} _B	D ^{eff} c	Deff	D ^{eff} ⊤	-
Average Crack equivalent source Infinite  Convection Source vapor effective foundation indoor source Unit  path vapor Crack flow rate diffusion Area of Peclet attenuation bidg, risk Reference  length, conc., radius, into bidg., coefficient, crack, number, coefficient, conc., factor, conc.,  L _p C _{source} r _{crack} Q _{soil} D ^{crack} A _{crack} exp(Pe ^f ) α C _{building} URF RfC  (cm) (μg/m³) (cm) (cm³/s) (cm²/s) (cm²) (unitless) (unitless) (μg/m³) (μg/m³) (μg/m³)	_	(cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)		(cm ² /s)	
Average Crack equivalent source Infinite  Convection Source vapor effective foundation indoor source Unit  path vapor Crack flow rate diffusion Area of Peclet attenuation bidg, risk Reference  length, conc., radius, into bidg., coefficient, crack, number, coefficient, conc., factor, conc.,  L _p C _{source} r _{crack} Q _{soil} D ^{crack} A _{crack} exp(Pe ^f ) α C _{building} URF RfC  (cm) (μg/m³) (cm) (cm³/s) (cm²/s) (cm²) (unitless) (unitless) (μg/m³) (μg/m³) (μg/m³)	_						<b>,</b>		,						
Average Crack equivalent source Infinite  Convection Source vapor effective foundation indoor source Unit  path vapor Crack flow rate diffusion Area of Peclet attenuation bldg. risk Reference length, conc., radius, into bldg., coefficient, crack, number, coefficient, conc.,  L _p C _{source} r _{crack} Q _{soil} D ^{crack} A _{crack} exp(Pe¹) α C _{building} URF RfC  (cm) (μg/m³) (cm) (cm³/s) (cm²/s) (cm²) (unitless) (unitless) (μg/m³) (μg/m³)¹¹ (mg/m³)	Ļ	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.97E-03	0.00E+00	0.00E+00	1.45E-04	7.55E-04	95
15 1.52E+03 0.10 8.33E+01 9.97E-03 4.00E+02 5.28E+90 4.52E-04 6.85E-01 2.0E-06 6.0E-01	200	path length, L _p	vapor conc., C _{source}	radius, r _{crack}	vapor flow rate into bldg., Q _{soil}	effective diffusion coefficient, D ^{crack}	crack, A _{crack}	equivalent foundation Peclet number, exp(Pe ^f )	source indoor attenuation coefficient, α	source bldg. conc., C _{building}	risk factor, URF	conc., RfC			
	· [	15	1.52E+03	0.10	8.33E+01	9.97E-03	4.00E+02	5.28E+90	4.52E-04	6.85E-01	2.0E-06	6.0E-01			

RESULTS SHEET

# **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater	Indoor exposure groundwater	Risk-based indoor exposure	Pure component water	Final indoor exposure	Incremental risk from vapor intrusion to	Hazard quotient from vapor intrusion to
conc., carcinogen (μg/L)	conc., noncarcinogen (μg/L)	groundwater conc., (μg/L)	solubility, S (μg/L)	groundwater conc., (μg/L)	indoor air, carcinogen (unitless)	indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	5.6E-07	1.1E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.24E+01	6.40E+03	(μg/L) 1.24E+01	(μg/L)	1.24E+01	NA	(unitiess)

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

GW-ADV Version 3.1; 02/04	CALCULATE RIS	K-BASED GROUI	NDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	×)			•			
Reset to		YES	OR	] .								
Defaults	CALCULATE INC	REMENTAL RISK		. GROUNDWAT	ER CONCENTRAT	ON (enter "X" in "YE	S" box and initial grou	ındwater conc. bel	low)			
		YES	X	]								
	ENTER	ENTER Initial										
. * *	Chemical CAS No.	groundwater										
	(numbers only,	conc., C _w			Chaminal	٠.						
	no dashes) 75014	(μg/L) 1.00E+01	- 1		Chemical		,. !					
		· · · · · · · · · · · · · · · · · · ·			yl chloride (chlor				· · · · · · · · · · · · · · · · · · ·			_
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ist add up to value o	ENTER of L _{wT} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A,	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type	OR	soil vapor	
	Ts	L _F	L _{WT}	h _A	h _B	h _C	water table,	directly above	(used to estimate soil vapor	UK .	permeability, k,	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm ² )	
	11	15	110	110	0	0	Α	S	s	· ·		j ,
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE ¥	Stratum A SCS	Stratum A soil dry	Stratum A	Stratum A soil water-filled	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C SCS	Stratum C	Stratum C	Stratum C
	soil type	bulk density,	soil total porosity,	porosity,	soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity.	soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	Lookup Soil Parameters	ρ _b ^A	п ^А	θ _w ^A (cm ³ /cm ³ )	Lookup Soil Parameters	ρ _b ^B	n ^B	θ _w ^B	Lookup Soil Parameters	ρ ₆ C	n ^C	θ _w C
		(g/cm³)	(unitless)			(g/cm³)	(unitless)	(cm³/cm³)		(g/cm³)	(unitless)	(cm³/cm³)
	S	1.80	0.330	0.054	<u> </u>	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
<u> </u>	space floor	Soil-bldg. pressure	space floor	space floor	Enclosed space	Floor-wall seam crack	Indoor air exchange		flow rate into bldg. OR			
	thickness,	differential,	length,	width,	height,	width,	rate,	Le	eave blank to calcula	te		
	L _{crack} (cm)	ΔP (g/cm-s ² )	L _e . (cm)	(cm)	H _B (cm)	w (cm)	ER (1/h)		Q _{soil} (L/m)			
			***************************************					<b>-</b>				
	10	40	1000	1000	244	0.1	0.25	_	5			
MORE +	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard						
	time for	time for	Exposure	Exposure	risk for	quotient for						
	carcinogens, AT _C	noncarcinogens, AT _{NC}	duration, ED	frequency, EF	carcinogens, TR.	noncarcinogens, THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	30	30	350	1.0E-06	1 1						
END					Used to calcul							

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ )-1	Reference conc., RfC (mg/m ³ )
4.005.04	1 4 005 05	0.00= 00								
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	4.4E-06	1.0E-01

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil Intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	$\theta_a^{\Lambda}$	$\theta_a^B$	$\theta_a^C$	Ste	k _i	k _{rg}	k _v	L _{cz}	n _{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	$X_{crack}$
(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	(cm²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm)
9.46E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
Bidg. ventilation rate,	Area of enclosed space below grade	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient, D ^{eff} _T	Diffusion path length,
Q _{building} (cm³/s)	A _B (cm²)	η (	Z _{crack}	ΔH _{v,TS}	H _{TS} (atm-m³/mol)	H' _{TS}	μτς	D ^{eff} _A (cm ² /s)	D ^{eff} B (cm²/s).	D ^{eff} c (cm²/s)	D ^{eff} cz (cm²/s)	(cm²/s)	L _d
(Cm /s)	(Citi )	(unitless)	(cm)	(cal/mol)	(atm-m/mor)	(unitless)	(g/cm-s)	(CIII 78)	(Citi 75).	(0111 75)	(CIII /S)	(CIII /5)	(cm)
1.69E+04	1.06E+06	3.77E-04	15	4,989	1.78E-02	7.63E-01	1.76E-04	1.34E-02	0.00E+00	0.00E+00	1.90E-04	9.95E-04	95
Convection path length, L _p (cm)	Source vapor conc., C _{source} (μg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soli} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³),1	Reference conc., RfC (mg/m³)	•		
15	7.63E+03	0.10	8.33E+01	1.34E-02	4.00E+02	4.11E+67	5.78E-04	4.41E+00	4.4E-06	1.0E-01	7		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	8.80E+06	NA	8.0E-06	4.2E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### **INCREMENTAL RISK CALCULATIONS:**

(mg/E) (mg/E) (mg/E) (mg/E) (dialess) (dialess)	Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
-------------------------------------------------	---------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------	----------------------------------------------------------	----------------------------------------------------------------	----------------------------------------------------------------------------	------------------------------------------------------------------------------

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

#### DATA ENTRY SHEET

GW-ADV sion 3.1; 02/04	CALCULATE RIS	K-BASED GROU	NDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	x)						
Reset to Defaults		YES	OR	]								
Delauits	CALCULATE INC	REMENTAL RISK YES	S FROM ACTUAL	. GROUNDWAT <b>1</b>	ER CONCENTRAT	iON (enter "X" in "YE	S" box and initial grou	ndwater conc. be	elow)		•	
	ENTER	ENTER	<u> </u>	J .								
	Chemical	Initial groundwater										
	CAS No. (numbers only,	conc., C _W		•								
	no dashes)	(μg/L)	• . 7		Chemical		1					
	67663	1.50E+01	J	L	Chloroform	<u> </u>	J *					
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ust add up to value o	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE .	Average soil/	below grade to bottom	Donth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
	groundwater	of enclosed	Depth below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability k _v	
	T _s (°C)	L _F (cm)	L _{WT} (cm)	h _A (cm)	h _B (cm)	h _C (cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
												1
	11	15	110	110	<u> </u>	<u> </u>	<u> </u>	S	S		L	J
											-	- ENTER
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
<del>.</del>	SCS	soil dry	soil total	soil water-filled	I SCS	soil dry	soil total	soil water-filled	s SCS	soil dry	soil totai	soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density.,	porosity,	porosity,	soil type	bulk density,	porosity, n ^C	porosity, θ _w ^C
	Lookup Soil Parameters	ρ,Α	n ^A	θ _w ^A (cm³/cm³)	Lookup Soil Parameters	ρ ₆ ⁸	n ^e	θ _w ^B (cm³/cm³)	Lookup Soil Parameters	ρ _ь ^C (g/cm³)	n- (unitless)	(cm³/cm³)
		(g/cm³)	(unitless)	(cm ^{-/cm⁻)}		· (g/cm³)	(unitless)	(cm /cm )		(g/ciri )	(unitiess)	(CIII /CIII )
	S	1.80	0.330	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER	•	ENTER Average vapor			
₩	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		flow rate into bldg.			
	floor	pressure	floor	floor	space	seam crack	air exchange		OR Leave blank to calcula	to.		
	thickness, L _{crack}	differential, ΔP	length, L _e	width, W _B	height, H _B	width, ' w	rate, ER		Q _{soi}			
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	- 	(L/m)			
	10	40	1000	1000	300	0.1	0.83	- ]	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
<u> </u>	Averaging	Averaging	_		Target	Target hazard						
	time for carcinogens,	time for noncarcinogens,	Exposure duration,	Exposure frequency,	risk for carcinogens,	quotient for noncarcinogens,						
•	AT _C	ATNC	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	25	25	250	1.0E-06	1 1	] .					
END						late risk-based concentration.						
			*				•					

Diffusivity Diffusivity in air, in water,  D _a D _w (cm ² /s) (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m³)
1.04E-01   1.00E-05	3.66E-03	25	6.988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ $(cm^3/cm^3)$	Stratum C soil air-filled porosity, e _s c (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm ³ /cm ³ )	Air-filled porosity in capillary zone, θ _{a.cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
Bidg. ventilation rate, Q _{bulding} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'18 (unitless)	Vapor viscosity at ave. soil temperature, µts (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	1.31E-02	0.00E+00	0.00E+00	1.96E-04	1.02E-03	95
Convection path length, Lp (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{bullding} (µg/m³)	Unit risk factor, URF (µg/m³)·¹	Reference conc., RfC (mg/m³)			
15	1.26E+03	0.10	8.33E+01	1,31E-02	4.00E+02	8.21E+68	1.45E-04	1.83E-01	2.3E-05	4.9E-02			

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	7.92E+06	210	· ·		
	1 (4/	19/7	7.926+06	NA		1.0E-06	2.6E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## INCREMENTAL RISK CALCULATIONS:

	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
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MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS soil dry soil total soil w	
Defaults  CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter 'X" in "YES" box and initial groundwater conc. below)  YES  X  ENTER	
ENTER   ENTER   Chemical   Groundwater   CAS No.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Corr.   Cor	
CAS No. (numbers only, no disshes)   Conc., (numbers only, no disshes)   Cay (ugf.)   Chemical	
Chemical CAS No. conc., (numbers only, Cw. no dashes) (µg/L)  Tight 7.00E+00  ENTER ENTER ENTER ENTER ENTER ENTER Coel (G28)  Totals must add up to value of L _{wt} (cell G28)  Tickness of soil of soil Stratum A Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B, Stratum B	
(numbers only, Cw no dashes) (µg/L)  Trichloroethylene  ENTER ENTER Depth Depth Depth Soil/ soil of soil of soil of soil of soil of soil of soil stratum A Soil type (cm²) (cm²)  Ts Lr Lwr (cm) (cm) (cm) (cm) (cm) (cm) (cm) (cm)	
Trichloroethylene  ENTER ENTER Depth Depth Solid was a stratum A Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B Suratum B S	
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MORE → Soil/ to boltom groundwater temperature, space floor, (cm) (cm) (cm) (cm) (cm) (cm) (cm) (cm)	
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70Or pressure floor floor space seam crack air exchange OR thickness, differential, length, width, height, width, rate, Leave blank to calculate	
Lorack ΔP L _B W _B H _B W ER Q _{soll}	
(cm) (g/cm-s²) (cm) (cm) (cm) (1/h) (L/m)	
10 40 1000 1000 300 0.1 0.83 5	
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Averaging Averaging Target Target hazard	
time for time for Exposure Exposure risk for quotient for carcinogens, noncarcinogens, duration, frequency, carcinogens, noncarcinogens,	
ATC ATNC ED EF TR THQ	
(yrs) (yrs) (days/yr) (unitless) (unitless)	
70 25 25 250 1.0E-06 1	
Used to calculate risk-based	

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

=	Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, e _a ^A (cm ³ /cm ³ )	Stratum B soil air-filled porosity, $\theta_a^B$ $(cm^3/cm^3)$	Stratum C soil air-filled porosity, $\theta_a{}^c$ (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w.cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
L	7.88E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
	Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, n (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{1S} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm²/s)	Stratum B effective diffusion coefficient, Deff B (cm²/s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
L	6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.97E-03	0.00E+00	0.00E+00	1.45E-04	7.55E-04	7 7 7
	Convection path length,  L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soll} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., C _{building} (μg/m ³ )	Unit risk factor, URF (µg/m³) ¹	Reference conc., RfC (mg/m³)	1.405-04	7.332-04	95
	15 END	1.52E+03	0.10	8.33E+01	9.97E-03	4.00E+02	5.28E+90	1.11E-04、	1.68E-01	1.1E-04	3.5E-02			

**RESULTS SHEET** 

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	<b>=</b>  ]	4.5E-06	3.3E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

#### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.55E+00	2.13E+03	1.55E+00	1.47E+06	1.55E+00	NA	

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

**GW-ADV** CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box) Version 3.1; 02/04 Reset to OR Defaults CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below) Х YES ENTER ENTER Initial groundwater Chemical CAS No. conc., (numbers only, Cw no dashes) (µg/L) 7.00E+00 79016 Trichloroethylene ENTER ENTER ENTER ENTER ENTER **ENTER** ENTER ENTER ENTER ENTER Depth Totals must add up to value of LwT (cell G28) Soll MORE Average below grade Thickness Thickness stratum A User-defined soil/ to bottom Depth Thickness of soll of soil Soil SCS stratum A of enclosed SCS groundwater below grade of soil stratum B, stratum C, stratum soil type soil vapor OR temperature. space floor, to water table, stratum A, (Enter value or 0) (Enter value or 0) directly above soil type (used to estimate permeability, directly above Ts LF hA hB ħς water table. soil vapor (°C) permeability) (cm²) (cm) (cm) (cm) (cm) (cm) (Enter A, B, or C) water table 15 110 110 0 11 ENTER ENTER ENTER **ENTER** ENTER ENTER ENTER ENTER **ENTER ENTER ENTER** ENTER MORE Stratum A Stratum A Stratum A Stratum A Stratum B Stratum B Stratum B Stratum B Stratum C Stratum C Stratum C Stratum C SCS soil dry soil total soil water-filled SCS soil dry soil total soil water-filled SCS sóil dry soil total soil water-filled porosity, soil type bulk density, porosity, porosity, soil type bulk density, porosity, porosity, soil type bulk density, porosity, nA  $\rho_b^C$ θ**"**C ρb θ,,Α  $\rho_b^{\ B}$ 'nB Lookup Soil Lookup Soil Lookup Soil Parameters Parameters Parameters (cm³/cm³)(cm³/cm³) (g/cm³) (unitless) (cm³/cm³) (g/cm³) (unitless) (g/cm³) (unitless) 0.330 1.66 0.375 0.054 1.66 0.375 0.054 1.80 0.054 S s s **ENTER** ENTER ENTER **ENTER** ENTER ENTER ENTER **ENTER** MORE Enclosed Enclosed Enclosed Average vapor space Soil-bldg. space space Enclosed Floor-wall Indoor flow rate into bldg. space seam crack air exchange OR pressure floor floor floor Leave blank to calculate thickness, differential, length, width, height, width, rate, ΔΡ WB ER Q_{soil} LB Нв L_{crack} (g/cm-s2) (L/m) (cm) (cm) (cm) (cm) (cm) (1/h) 40 1000 1000 300 0.1 0.83 10 MORE **ENTER** ENTER ENTER ENTER ENTER **ENTER** Averaging Averaging Target Target hazard time for risk for quotient for time for Exposure Exposure carcinogens, noncarcinogens, duration, frequency, carcinogens, noncarcinogens, AT_{NC} ΕĐ EF TR THQ AT_C (vrs) (yrs) (vrs) (days/yr) (unitless) (unitless) 25 250 70 25 1.0E-06 Used to calculate risk-based END groundwater concentration.

Diffusivity Diffus in air, in wa $D_a$ $D_w$ $(cm^2/s)$ $(cm^2/s)$	ter, temperature,	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³)-1	Reference conc., RfC (mg/m ³ )
7.005.00   0.405								(1-37	(g,
7.90E-02 9.10E	-06   1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	.θ _a ^	θ _a ^B	$\theta_{\mathbf{a}}^{\mathbf{C}}$	Ste	· k _i	k _{rg}	, k _v	Lcz	n _{cz}	θ _{a,cz}	$\theta_{w,cz}$	$X_{crack}$
(sec)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
7.005.00	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
7.88E+08	1 95	0.276	0.321	0.321	0.004	9.546-00	0.556	9.92E-00	. 17.03	1 0.55	0.077	1 0.200	1 4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  HTs (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'Ts (unitless)	Vapor viscosity at ave. soil temperature, μ _{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} ₈ (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm²/s)	Total overall effective diffusion coefficient, [Cm ² /s]	Diffusion path length, L _d (cm)
(0111 70)	(0 /	(dilidoso)	(0.1.7	(Gairrior)		(diminos)	(5,0/						
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.97E-03	0.00E+00	0.00E+00	1.45E-04	7.55E-04	95
Convection	Source		Average vapor	Crack effective	**************************************	Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit risk	Reference			
path	vapor	Crack	flow rate	diffusion coefficient,	Area of crack,	Peclet number.	attenuation coefficient,	bldg. conc.	factor,	conc.,			
length,	conc.,	radius,	into bldg.,	D ^{crack}		exp(Pe ^f )			URF	RfC			
L _p	C _{source}	(crack	Q _{soil} (cm³/s)	(cm²/s)	A _{crack} (cm²)	(unitless)	α (unitless)	C _{building} (μg/m³)	(μg/m ³ ) ⁻¹	(mg/m³)			
(cm)	(μg/m³)	(cm)	(011/5)	(011175)	(4117)	(0000055)	(unidess)	(μg//// /	(149,111)	(9/, /	•		
15	1.52E+03	0.10	8.33E+01	9.97E-03	4.00E+02	5.28E+90	1.11E-04	1.68E-01	2.0E-06	6.0E-01	]		

RESULTS SHEET

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	] [	8.2E-08	1.9E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor	Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure	exposure	indoor	component	indoor		vapor	from vapor
groundwater conc.,	groundwater conc.,	exposure groundwater	water solubility,	exposure groundwater		intrusion to indoor air,	intrusion to indoor air,
carcinogen (μg/L)	noncarcinogen (μg/L)	conc., (μg/L)	S (µg/L)	conc., (μg/L)	•	carcinogen (unitless)	noncarcinogen (unitless)
**************************************							
8.53E+01	3.66E+04	8.53E+01	1.47E+06	8.53E+01		NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

		1.											
	GW-ADV	CALCULATE R	ISK-BASED GROU	INDWATER CON	CENTRATION /-	nter "X" in "YES" bo							
	on 3.1; 02/04	5,1200211211	011-02-0100	MOWATER CON	SEIVITATION (e	nter X in "YES" Do	(x)						
v el Si	011 3. 1, 02/04				_								
			YES		1		•						
1	Reset to			OR									
1	Defaults	OA1 OI II A TT III											
<u> </u>		CALCULATE IN	CREMENTAL RISI	KS FROM ACTUA	L GROUNDWAT	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	undwater conc. be	elow)			
					-			·					
			YES	X									
		ENTER	ENTER										
			Initial										
		Chemical	groundwater										
		CAS No.	conc.,										
		(numbers only,											
		no dashes)	(μg/L)										
		110 desites)	(µg/L)	-		Chemical							
		75044		_				_					
		75014	1.00E+01		Viny	/l chloride (chlor	oethene)						
						· · · · · · · · · · · · · · · · · · ·							
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	CUTED	<del></del>		3
			Depth			st add up to value o		ENIER	ENIER	ENTER		ENTER	
	MORE	Average	below grade		Totals into					Soil			ļ
	¥	soil/	to bottom	Depth	Tu: -1	Thickness	Thickness		•	stratum A		User-defined	i
	لسنت	groundwater	of enclosed		Thickness	of soil_	of soil	Soil		SCS		stratum A	
		temperature,		below grade	of soil	stratum B,	stratum C,	stratum	SCS	soil type		soil vapor	Į.
			space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
		Ts	L _F	L _{WT}	h _A	h _B	· h _c	water table,	directly above	soil vapor		k,	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
								(2,110,71,0,0,0)	Water lable	T permeability)	•	(Crit )	į
		11	15	110	110	0	0	A	T	<del>                                       </del>	1		
				<del></del>					<u> </u>	S			1
													•
													•
		ENTER	ENTER	FNTER	ENTER	ENTED	ENTED	ENTER					•
	MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
	MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	ENTER Stratum C
	MORE ¥	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total . porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C	Stratum C soil dry bulk density	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb ^A	Stratum A soil total	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density,	Stratum B soil total	Stratum B soil water-filled porosity,	Stratum C SCS	Stratum C soil dry bulk density	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total . porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density, p _b B	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^C$
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb ^A	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb ^A	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
		Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, p _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density, p _b B	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^C$
		Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, p _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $ ho_b^B$ (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
		Stratum A SCS SOII type Lookup Soil Parameters	Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	Stratum A soil total porosity, n^ (unitless)	Stratum A soil water-filled porosity, θ _w ^ (cm³/cm³)  0.054  ENTER	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS SOII type Lookup Soil Parameters  S ENTER	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
		Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b B (g/cm ³ )  1.66 ENTER	Stratum B soil total porosity, n ^B (unitless) 0.375	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space	Stratum A soil dry bulk density, p _b ^A (g/cm³)  1.80  ENTER Soil-bldg.	Stratum A soil total porosity, n^ (unitless)  ENTER Enclosed space	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters S ENTER Enclosed	Stratum B soil dry bulk density, p. B (g/cm³)  1.66  ENTER Floor-wall	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg.	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor	Stratum A soil dry bulk density, Pp ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor	Stratum A soil water-filled porosity, θ _w ^ (cm³/cm³)  0.054  ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled poosity, \$\theta_u^A\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p _b ^B (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S  ENTER Enclosed space floor thickness, Lorack	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled poosity, \$\theta_w^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_B\$	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length,	Stratum A soil water-filled poosity, \$\theta_u^A\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p _b ^B (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil pe Lookup Soil Parameters  S  ENTER Enclosed space floor thickness, Lorack (cm)	Stratum A soil dry bulk density, Pp ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s ² )	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)	Stratum A soil water-filled porosity, θ _c , (cm ³ /cm ³ )  0.054  ENTER Enclosed space floor width, W ₈ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p _b B (g/cm³)  1.66  ENTER Floor-wall seam crack width, w	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  S  ENTER Enclosed space floor thickness, Lorack	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled poosity, \$\theta_w^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_B\$	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p _b B (g/cm³)  1.66  ENTER Floor-wall seam crack width, w	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE +	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor thickness, Lorack (cm)	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_w^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_B\$ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER	Stratum A soli dry bulk density, P _b A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)	Stratum A soil water-filled porosity, θ _c , (cm ³ /cm ³ )  0.054  ENTER Enclosed space floor width, W ₈ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE +	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, $\Delta P$ (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_w^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_B\$ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil parameters  SENTER Enclosed space floor thickness, Larack (cm)  10  ENTER Averaging time for	Stratum A soli dry bulk density, P _b A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, \$\theta_w^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_B\$ (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER	Stratum B soil dry bulk density, p ₆ ^B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil Parameters  S ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging	Stratum A soil dry bulk density, Pb (g/cm³)  1.80  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging	Stratum A soil total porosity, n ^A (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled poosity, \$\theta_{\text{u}}^{\text{A}}\$ (cm^3/cm^3)  0.054  ENTER Enclosed space floor width, \$W_{\text{B}}\$ (cm)  1000  ENTER  Exposure	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for	Stratum B soil dry bulk density; p _b ^B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  ENTER Averaging time for carcinogens,	Stratum A soll dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tex{\tex	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pp ^A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  O.330  ENTER Enclosed space floor length, L _s (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, e, ^ (cm³/cm³)  0.054  ENTER Enclosed space floor width, Wa (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p b (g/cm³)  1.66 ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for nonaccinogens, THQ	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  ENTER Averaging time for carcinogens,	Stratum A soll dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tex{\tex	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C (yrs)	Stratum A soll dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_a^N\$ (cm^3/cm^2) \$\text{0.054}\$ ENTER Enclosed space floor width, \$W_B\$ (cm) \$\text{1000}\$ ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, p. B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pp ^A (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  O.330  ENTER Enclosed space floor length, L _s (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, e, ^ (cm³/cm³)  0.054  ENTER Enclosed space floor width, Wa (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p b (g/cm³)  1.66 ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for nonaccinogens, THQ	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C (yrs)	Stratum A soll dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_a^N\$ (cm^3/cm^2) \$\text{0.054}\$ ENTER Enclosed space floor width, \$W_B\$ (cm) \$\text{1000}\$ ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H ₈ (cm) 300 ENTER Target risk for carcinogens, TR (unitless) 1.0E-06	Stratum B soil dry bulk density, p b (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	MORE UMORE	Stratum A SCS soil type Lookup Soil type Lookup Soil Parameters  SENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, AT _C (yrs)	Stratum A soll dry bulk density, PbA (g/cm³)  1.80  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.330  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\theta_a^N\$ (cm^3/cm^2) \$\text{0.054}\$ ENTER Enclosed space floor width, \$W_B\$ (cm) \$\text{1000}\$ ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density; p _B g (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, 6 B (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, P _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔΗ _{ν,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	4.4E-06	1.0E-01

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	95	0.276	0.321	0.321	0.004	9.94E-08	0.998	9.92E-08	17.05	0.33	0.077	0.253	4,000
Bldg. ventilation rate, Q _{bulding} (cm³/s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,rs}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ⁹ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, Deff (cm²/s)	Diffusion path length,
6.92E+04	1.06E+06	3.77E-04	15	4,989	1.78E-02	7.63E-01	1.76E-04	1.34E-02	0.00E+00	0.00E+00	1.90E-04	9.95E-04	95
Convection path length, L _p (cm)	Source vapor conc. C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{orack} (cm²/s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	7.63E+03	0.10	8.33E+01	1.34E-02	4.00E+02	4.11E+67	1.42E-04	1.08E+00	4.4E-06	1.0E-01	•		

**RESULTS SHEET** 

## **INCREMENTAL RISK CALCULATIONS:**

Indoor	Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure groundwater conc.,	exposure groundwater conc.,	indoor exposure groundwater	component water solubility,	indoor exposure groundwater		vapor intrusion to indoor air,	from vapor intrusion to indoor air,
carcinogen (μg/L)	noncarcinogen (μg/L)	conc., (μg/L)	S (μg/L)	conc., (μg/L)		carcinogen (unitless)	noncarcinogen (unitless)
NA	NA	NA	8.80E+06	NA	[	1.2E-06	7.4E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
8.60E+00	1.35E+03	8.60E+00	8.80E+06	8.60E+00	NA	l NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 7

RESIDENTIAL

#### DATA ENTRY SHEET

.1; 02/04	CALCULATE RIS			_								
et to		YES	OR	]								
ults	CALCULATE INC	REMENTAL RISK		GROUNDWATE	ER CONCENTRATI	ON (enter "X" in "YE	S" box and initial grou	ndwater conc. be	low)			
		YES	X	] .								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No. (numbers only,	conc., C _w										
	no dashes)	(µg/L)	_		Chemical		·					
	79016	1.00E+00	]		Trichloroethyle	ene						
	ENTER	ENTER Depth	ENTER	ENTER Totals mus	ENTER st add up to value o	ENTER	ENTER	ENTER	ENTER Soil		ENTER	]
MORE	Average	below grade			Thickness	Thickness	<b>C</b> -11		stratum A SCS		User-defined stratum A	
	soil/ groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C,	Soil stratum	scs	soil type		soil vapor	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
	T _s	L _F	Lwt	h _A	h _B	h _C	water table, (Enter A, B, or C)	directly above water table	soil vapor permeability)		k, (cm²)	
	(°C).	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(6.11 )	
	11	15	150	150	0	0	A	LS	LS	<del></del>		]
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum
Ψ .	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-f porosity
	soil type	bulk density, ρ _ь ^A	porosity, n ^A	porosity, θ _w ^	Soil type	bulk density, ρ _ь 8	porosity,	ροιοsity, θ _w ⁸	Lookup Soil	ρ _b C	n ^C	θ _w C
	Parameters	(g/cm ³ )	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm
											(GINEGEO)	
	LS	1,60	0.370	0.076	\$	1.66	0.375	0.054	s	1.66	0.375	0.054
WORE	ENTER	1,60 ENTER	ENTER	ENTER	S ENTER	1.66 ENTER			ENTER			0.054
MORE ↓							0.375		ENTER Average vapor flow rate into bidg.			0.054
MORE ↓	ENTER Enclosed space floor	ENTER Soil-bidg. pressure	ENTER Enclosed space floor	ENTER Enclosed space floor	ENTER  Enclosed  space	ENTER Floor-wall seam crack	0.375  ENTER Indoor air exchange	0.054	ENTER Average vapor flow rate into bldg. OR	1.66		0.054
MORE ¥	ENTER Enclosed space floor thickness,	ENTER Soil-bldg. pressure differential,	ENTER Enclosed space floor length,	ENTER Enclosed space floor width,	ENTER  Enclosed  space height,	ENTER Floor-wall seam crack width,	0.375  ENTER Indoor air exchange rate,	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculate	1.66		0.054
MORE ¥	ENTER Enclosed space floor	ENTER Soil-bidg. pressure	ENTER Enclosed space floor	ENTER Enclosed space floor	ENTER  Enclosed  space	ENTER Floor-wall seam crack	0.375  ENTER Indoor air exchange	0.054	ENTER Average vapor flow rate into bldg. OR	1.66		0.054
MORE ↓	ENTER Enclosed space floor thickness, L _{crack}	ENTER Soil-bldg. pressure differential, ΔP	ENTER Enclosed space floor length, L _B	ENTER Enclosed space floor width, W _B	ENTER  Enclosed space height, H _B	ENTER Floor-wall seam crack width, w	0.375  ENTER Indoor air exchange rate, ER	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat	1.66		0.054
<u> </u>	ENTER Enclosed space floor thickness, L _{crack} (cm)	ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, Ls (cm)	ENTER Enclosed space floor width, We (cm)	ENTER Enclosed space height, H ₈ (cm)	ENTER Floor-wall seam crack width, w (cm)	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
MORE WORE	ENTER Enclosed space floor thickness, L_crack (cm)  10  ENTER Averaging	ENTER  Soil-bidg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging	ENTER Enclosed space floor length, L _B (cm) 1000 ENTER	ENTER Enclosed space floor width, Ws (cm) 1000 ENTER	ENTER  Enclosed space height, H _B (cm)  244  ENTER Target	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
MORE	ENTER Enclosed space floor thickness, L-rack (cm)  10  ENTER Averaging time for	ENTER  Soil-bidg. pressure differential,  ΔP (g/cm-s²)  40  ENTER Averaging time for	ENTER Enclosed space floor length, L _B (cm)  1000  ENTER Exposure	ENTER Enclosed space floor width, W ₈ (cm)  1000  ENTER  Exposure	ENTER  Enclosed space height, H _B (cm)  244  ENTER Target risk for	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
<b>₩</b>	ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens,	ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging time for noncarcinogens,	ENTER Enclosed space floor length, Lg (cm)  1000  ENTER  Exposure duration,	ENTER Enclosed space floor width, We (cm)  1000  ENTER  Exposure frequency,	ENTER  Enclosed space height, H ₆ (cm)  244  ENTER Target risk for carcinogens,	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens,	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
MORE	ENTER Enclosed space floor thickness, L-rack (cm)  10  ENTER Averaging time for	ENTER  Soil-bidg. pressure differential,  ΔP (g/cm-s²)  40  ENTER Averaging time for	ENTER Enclosed space floor length, L _B (cm)  1000  ENTER Exposure	ENTER Enclosed space floor width, W ₈ (cm)  1000  ENTER  Exposure	ENTER  Enclosed space height, H _B (cm)  244  ENTER Target risk for	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
<b>₩</b>	ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _C	ENTER  Soil-bidg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, $\Delta T_{NC}$	ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED	ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF	ENTER  Enclosed space height, H ₈ (cm)  244  ENTER Target risk for carcinogens, TR	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054
<b>↓</b>	ENTER Enclosed space floor thickness, L _{crack} (cm)  10  ENTER Averaging time for carcinogens, AT _C (yrs)	ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	ENTER Enclosed space floor length, Ls (cm)  1000 ENTER Exposure duration, EO (yrs)	ENTER Enclosed space floor width, W _B (cm)  1000  ENTER  Exposure frequency, EF (days/yr)	ENTER  Enclosed space height, H ₈ (cm)  244  ENTER Target risk for carcinogens, TR (unitless)	Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitiess)	0.375  ENTER Indoor air exchange rate, ER (1/h)	0.054	ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	1.66		0.054

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point,	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposu duration	n, separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	θ _a ^A	θ _a ^B	θ _a C	S _{te}	K _i	k _{rg}	Κ _ν	L _{cz}	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	X _{crack}
(sec)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm /cm )	(cm /cm )	(CHI /CHI )	(cm)
9.46E+0	8 135	0.294	0.321	0.321	0.084	1.63E-08	0.955	1.55E-08	18.75	0.37	0.067	0.303	4,000
											**		
Bldg. ventilation rate,	Area of enclosed space on below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient,	Diffusion path length,
Q _{building}		η	$Z_{crack}$	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	$\mu_{TS}$	Deff	D _{ell} ^B	Deff	Deff	Deff⊥	L _d
(cm³/s	) (cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm ² /s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
1.69E+0	4 1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.79E-03	0.00E+00	0.00E+00	7.83E-05	5.37E-04	135
Convecti path length L _p (cm)	vapor	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soll} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
			T 0 00 0 0 0			0 555 00	1 0075 01	1 5 105 00	4.504	0.55.66	1		
15	2.17E+02	0.10	8.33E+01	9.79E-03	4.00E+02	2.57E+92	2.37E-Q4	5.13E-02	1.1E-04	3.5E-02			

**RESULTS SHEET** 

## INCREMENTAL RISK CALCULATIONS:

			_			Incremental	Hazard
Indoor	Indoor	Risk-based	Pure	Final		risk from	quotient
exposure	exposure	indoor	component	indoor		vapor	from vapor
groundwater	groundwater	exposure	water	exposure		intrusion to	intrusion to
conc.,	conc.,	groundwater	solubility,	groundwater	•	indoor air,	indoor air,
carcinogen	noncarcinogen	conc.,	S	conc.,		carcinogen	noncarcinogen
(μg/ <b>L</b> )	(μg/L)	(μg/L)	(μg/L)	(μg/L)		(unitless)	(unitless)
	·	<del></del>	·			·	· · · · · · · · · · · · · · · · · · ·
NA NA	NA	NA	1.47E+06	NA		2.3E-06	1.4E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
4.31E-01	7.11E+02	4.31E-01	1.47E+06	4.31E-01	- 	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

3W-ADV	CALCULATE RIS	SK-BASED GROUN	IDWATER CONG	CENTRATION (	enter "X" in "YES" b	ox)						
on 3.1; 02/04		YES	·	7								
Reset to		765	OR	نـ					*			
Defaults	CALCULATE INC	CREMENTAL RISK		L GROUNDWA	TER CONCENTRA	TION (enter "Y" in "YE	S" box and initial grou	andurator sona h	nia)			
				- C.1001121171	, LIN GONGEITHION	non (enter X III 12	o box and miliar grou	mowater conc. of	siow)			
		YES	X									
	ENTER	ENTER										
	Chaminal	Initial										
	Chemical CAS No.	groundwater conc.,										
	(numbers only,	C _w										
	no dashes)	(μg/L)			Chemical							
	79016	1.00E+00			Trichloroethy	lene	!			*		
						iono						
	ENTER	ENTER Depth	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	···	ENTER	7
MORE	Average	below grade		rotals mi	ust add up to value Thickness	of L _{WT} (cell G28) Thickness	**		Soil			ļ
<b>.</b>	soil/	to bottom	Depth	Thickness	of soil	of soil	Soil		stratum A SCS		User-defined stratum A	
	groundwater temperature,	of enclosed space floor,	below grade to water table,	of soil stratum A	stratum B, (Enter value or 0)	stratum C,	stratum	scs	soil type		soil vapor	
	Ts	L _F	L _{WT}	h _A	h _B	(Enter value or 0) h _C	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	1
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	150	150	Ó	0				1		1
		<u> </u>		130	<u> </u>	<u>.                                    </u>	A	<u>LS</u>	LS	····		1
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER			
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
•	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled		soil dry	soil total	soil water-filled	scs	soil dry	soil total	soil water-filled
	Lookup Soil	ρ _b ^A	n ^A	porosity, θ _ω ^A	Soil type  Lookup Soil	bulk density, ρ _ь ^B	porosity, n ^e	porosity, θ _ω ^B	Soil type  Lookup Soil	bulk density, ρ _ι c	porosity, n ^C	porosity, θ _w ^C
	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm ³ )	(unitless)	(cm³/cm³)	Parameters	ρ _δ (g/cm³)	(unitless)	e"- (cm³/cm³)
	LS	1.60	0.030	0.070								
	<u> </u>	1.60	0.370	0.076	S	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
WORE +	Enclosed space	Soil-bldg.	Enclosed space	Enclosed space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bldg.			
	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness, L _{crack}	differential, ΔP	length,	width,	height,	width,	rate,	L	eave blank to calcula	te		
	(cm)	(g/cm-s²)	L _B (cm)	W _B (cm)	H _B (cm)	w (cm)	ER (1/h)		Q _{soil}			
							(771)	•	(L/m)			
	10	40	1000	1000	244	0.1	0.25	]	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
	Averaging time for	Averaging time for	Exposure	Evenaura	Target	Target hazard						
		noncarcinogens,	duration,	Exposure frequency,	risk for carcinogens,	quotient for noncarcinogens,						
	AT _C	AT _{NC}	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	30	30	350	1.0E-06	1						
					Used to calcu	ilate risk-based						
END						concentration.				•		

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_e^A$ $(cm^3/cm^3)$	Stratum B soil air-filled porosity, $\theta_a^B$ $(cm^3/cm^3)$	Stratum C soil air-filled porosity, e _a ^c (cm ³ /cm ³ )	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm ³ /cm ³ )	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
9.46E+08	135	0.294	0.321	0.321	0.084	1.63E-08	0.955	4.555.00			,		
				0.021	0.004	1.03E-06	1 0.955	1.55E-08	18.75	0.37	0.067	0.303	4,000
Bidg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'Ts (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, Deff _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.79E-03	0.005.00	0.005.00	7.00		
Convection path length, Lp (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm³/s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	infinite source indoor attenuation coefficient, α (unitless)	Infinite source bidg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³)-1	Reference conc., RfC (mg/m³)	7.83E-05	5.37E-04	135
END													

**RESULTS SHEET** 

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA NA	NA NA	NA	1.47E+06	NA	4.2E-08	8.2E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.37E+01	1.22E+04	2.37E+01	1.47E+06	2.37E+01	 NA NA	I NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

GW-ADV	CALCULATE RIS	SK-BASED GROU	INDWATER CONC	ENTRATION (e	inter "X" in "YES" be	ox)						
rsion 3.1; 02/04				,								
Reset to		YES	L	J		•						
Defaults	CALCULATE IN	ODEMENTAL DIO	OR									
	CALCULATE INC	CREMENTAL RISE	KS FROM ACTUAL	. GROUNDWA	TER CONCENTRAT	TiON (enter "X" in "YE	S" box and initial grou	undwater conc. be	low)			
		YES	X	1								
				• .								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No.	conc.,						•				
	(numbers only,	Cw			•							
	no dashes)	(μg/L)	_		Chemical							
	79016	1.00E+00	7		Trichleseethyd		1					
		1	J		Trichloroethyl	епе		•				
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	7
		Depth		Totals mu	ust add up to value		]		Soil		LITTLE	1
MORE ¥	Average soil/	below grade			Thickness	Thickness	]_		stratum A		User-defined	
ا	groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C,	Soil	000	scs		stratum A	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		stratum directly above	SCS soil type	soil type (used to estimate	OR	soil vapor permeability,	
•	Ts	LF	Lwt	h _A	he	h _c	water table,	directly above	soil vapor	OK.	k _v	
	(°C)	(cm)	(cm)	(cm) .	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	į
	11	15	150	150	0	0						]
	<u> </u>		1 130	150	U U		<u> </u>	LS	LS	<u> </u>	<u> </u>	ļ
MORE	ENTER Stratum A	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
₩.O.K.E	SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum 8 soil water-filled	Stratum C	Stratum C	Stratum C	Stratum C
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	Lookup Soil	$\rho_b^A$	n ^A .	θ.,^	Lookup Soil	ρь ^B	n ^B	θ _w B	Lookup Soil	ρ _b C	n ^c	θ _w C
	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	LS	1.60	0.370	0.076		1.00					V	
		1.00	0.370	0.076	S	1.66	0.375	0.054	s	1.66	0.375	0.054
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE	Enclosed space	C-11 514-	Enclosed	Enclosed					Average vapor			
	floor	Soil-bldg. pressure	space	space floor	Enclosed space	Floor-wall seam crack	Indoor air exchange		flow rate into bldg.			
	thickness,	differential,	length,	width,	height,	width,	rate,	Le	OR eave blank to calcula	te .		
	L _{crack}	ΔP	LB	Wa	H _B	w	ER		Q _{soil}			
	(cm)	(g/cm-s²)	(cm)	(cm)	(cm)	(cm)	(1/h)	•	(L/m)			
	10	40	1000	1000	300	0.1	0.83	7				
			1	1000	300	<u> </u>	0.03	1	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
	Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard						
		noncarcinogens,	duration,	frequency,	carcinogens,	quotient for noncarcinogens,						
	AT _C	ATNC	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitiess)						
	70	25	25	250	1.0E-06	1						
	<del></del>		·		1,00-70	· · · · · · · · · · · · · · · · · · ·						
END					Used to calcul							
L END				ı	groundwater :	concentration						

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm ³ /cm ³ )	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _l (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm²)	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{e,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	135	0.294	0.321	0.321	0.084	1.63E-08	0.955	1.55E-08	18.75	0.37	0.067	0.303	4,000
Bldg. ventilation rate, Q _{building} (cm³/s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'Ts' (unitless)	Vapor viscosity at ave. soil temperature, µts (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} B (cm ² /s)	Stratum C effective diffusion coefficient, Deff c (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.79E-03	0.00E+00	0.00E+00	7.83E-05	5.37E-04	
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bidg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)	/.63E-U5	3.3/E-U4	135
15	2.17E+02	0.10	8.33E+01	9.79E-03	4.00E+02	2.57E+92	5.81E-05	1.26E-02	1.1E-04	3.5E-02			

#### **RESULTS SHEET**

#### RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	3.4E-07	2.5E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.96E+00	4.06E+03	2.96E+00	1.47E+06	2.96E+00	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

GW-ADV	CALCULATE RIS	SK-BASED GROUI	NDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	x)						
ion 3.1; 02/04		YES	F	1								
Reset to			OR									
Defaults	CALCULATE IN	CREMENTAL RISK	S FROM ACTUAL	. GROUNDWA	TER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	elow)			
		YES	X	7								
				_								
	ENTER	ENTER Initial			•							
	Chemical	groundwater										
	CAS No. (numbers only,	conc., C _w										
	no dashes)	(μg/L)	_		Chemical							
	79016	1.00E+00	] .		Trichloroethyle	ene						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	1
MORE	Average	Depth below grade		Totals mu	ust add up to value o		· .		Soil		User-defined	<b>.</b>
₩ V	soil/	to bottom	Depth	Thickness	of soil	Thickness of soil	Soil		stratum A SCS		stratum A	
	groundwater temperature,	of enclosed space floor,	below grade	of soil	stratum B, (Enter value or 0)	stratum C,	stratum	SCS	soil type	00	soil vapor	
	T _S	Space 1001,	to water table, L _{wt}	stratum A,	(Enter value or 0)	(Enter value or 0) h _C	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm ² )	
	11	15	150	150	0	0	A	LS	LS		· · · · · · · · · · · · · · · · · · ·	
												•
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE ¥	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
	Lookup Soil Parameters	ρ,Α	n ^A	θ,, Α	Lookup Soil Parameters	ρ ₆ 8	u _e	θ, Β	Lookup Soil Parameters	$\rho_b^{C}$	uc	θ _w C
		(g/cm³)	(unitless)	(cm ³ /cm ³ )		(g/cm³)	(unitless)	(cm ³ /cm ³ )	( ) distribution	(g/cm ³ )	(unitless)	(cm³/cm³)
	LS	1.60	0.370	0.076	S	1.66	0.375	0.054	s	1.66	0.375	0.054
·	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MORE .	Enclosed space	Soil-bldg.	Enclosed space	Enclosed space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bldg.			
L	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness,	differential,	length,	width,	height,	width,	rate,	L	eave blank to calculat	te		
	L _{creck} (cm)	ΔP (g/cm-s²)	L _B	W _B	H _B (cm)	w (cm)	ER (1/h)		Q _{soi} (L/m)			
								•				
	10	40 .	1000	1000	300	0.1	0.83	j ·	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
<b>—</b>	Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard quotient for						
	carcinogens,	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,			•			
	AT _C (yrs)	AT _{NC} (yrs)	ED (yrs)	ЕF (days/уг)	TR (unitless)	THQ (unitless)						
		~		· · · · · · · · · · · · · · · · · · ·								
•	70	25	25	250	1.0E-06	1						
END						late risk-based concentration.			•			

## CHEMICAL PROPERTIES SHEET

(cm/s) (cm/s) (atri-in/mol) ( c) (cal/mol) ( k) (cm/g) (mg/L)	(μg/m ³ ) ⁻¹	(mg/m³)
7.90E-02 9.10E-06 1.03E-02 25 7,505 360.36 544.20 1.66E+02 1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
	τ.	L _T	θ _a ^A 3.	θ _a ^B	θ _a ^C	S _{te}	k _i	k _{rg}	k,	L _{cz}	n _{cz}	θ _{a,cz}	θ _{w,cz} (cm³/cm³)	X _{crack}
-	(sec)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm ² )	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm /cm )	(cm)
[	7.88E+08	135	0.294	0.321	0.321	0.084	1.63E-08	0.955	1.55E-08	18.75	0.37	0.067	0.303	4,000
	Bidg. ventilation rate, Q _{bull³/s)}	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, µтs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} ₈ (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
Г	6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	9.79E-03	0.00E+00	0.00E+00	7.83E-05	5.37E-04	135
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
	15	2.17E+02	0.10	8.33E+01	9.79E-03	4.00E+02	2.57E+92	5.81E-05	1.26E-02	2.0E-06	6.0E-01	]		

**RESULTS SHEET** 

### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	1	risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA		6.2E-09	1.4E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc.,	Indoor exposure groundwater conc	Risk-based indoor exposure groundwater	Pure component water solubility.	Final indoor exposure groundwater	 ncremental risk from vapor intrusion to indoor air.	Hazard quotient from vapor intrusion to indoor air,
carcinogen (mg/L)	noncarcinogen (mg/L)	conc., (mg/L)	S (mg/L)	conc., (mg/L)	carcinogen (unitless)	noncarcinogen (unitless)
1.63E+02	6.97E+04	1.63E+02	1.47E+06	1.63E+02	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 15

RESIDENTIAL

GW-ADV /ersion 3.1; 02/04	CALCULATE F	RISK-BASED GROU	NDWATER CON	CENTRATION (	enter "X" in "YES" bo	(x)						
Reset to		YES	OR	]								
Defaults	CALCULATE IN	NCREMENTAL RISH		L GROUNDWA	TER CONCENTRAT	ON (enter "X" in "YE	S" box and initial gro	undwater conc. be	elow)	4		
		YES	X	]								
	ENTER	ENTER Initial										
	Chemical CAS No.	groundwater conc.,										
	(numbers only no dashes)	, C _w (μg/L)			Chemical							
	67663	3.00E+00	]		Chloroform							
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ust add up to value o	ENTER	ENTER	ENTER	ENTER Soll	<del></del>	ENTER	1
MORE ↓	Average soil/ groundwater temperature,	below grade to bottom of enclosed space floor,	Depth below grade to water table,	Thickness of soil stratum A,	Thickness of soil stratum B, (Enter value or 0)	Thickness of soil stratum C, (Enter value or 0)	Soil stratum directly above	SCS soil type	stratum A SCS soil type (used to estimate	OR	User-defined stratum A soil vapor permeability,	
	T _s (°C)	L _F (cm)	L _{WT} (cm)	h _A (cm)	h _B (cm)	h _C (cm)	water table, (Enter A, B, or C)	directly above water table	soil vapor permeability)		k _v (cm²)	
	11	15	200	200	0	0	A	LS	LS			
MORE ¥	ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density,	ENTER Stratum A soil total porosity,	ENTER Stratum A soil water-filled porosity,	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity,	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density,	ENTER Stratum C soil total porosity,	ENTER Stratum C soil water-filled porosity,
	Lookup Soil Parameters	ρ _δ ^ (g/cm ³ )	n ^A (unitless)	θ _w ^A (cm³/cm³)	Lookup Soil Parameters	ρ _ь ^B (g/cm³)	n ^B (unitless)	θ _w ^B (cm³/cm³)	Lookup Soil Parameters	ρ _ь ^c (g/cm³)	n ^C (unitless)	θ _w ^C (cm³/cm³)
	LS	1.50	0.450	0.076	S	1.66	0.375	0.054	s	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
	space floor thickness, L _{crack}	Soil-bidg. pressure differential, ΔP	space floor length,	space floor width,	Enclosed space height,	Floor-wall seam crack width,	Indoor air exchange rate,	Le	flow rate into bldg. OR eave blank to calculat	 <del>e</del>		
	(cm)	(g/cm-s ² )	L _B	W _B (cm)	H _B (cm)	w (cm)	ER (1/h)		Q _{soil} (L/m)			
	10	40	1000	1000	244	0.1	0.25	· · ·	5			
MORE ¥	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard		•				
	time for carcinogens, AT _C	time for noncarcinogens, AT _{NC}	Exposure duration, ED	Exposure frequency, EF	risk for carcinogens, TR	quotient for noncarcinogens,						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	THQ (unitless)						
	70	30	30	350	1.0E-06							
END					Used to calcula							

## CHEMICAL PROPERTIES SHEET

	Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)
	1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm ³ /cm ³ )	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a ^C (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
9.46E+08	185	0.374	0.321	0.321	0.067	1.63E-08	0.964	1.57E-08	18.75	0.45	0.147	0.303	4,000
										<u> </u>	1		1 -,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} B (cm²/s)	Stratum C effective diffusion coefficient, Deff c (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, $D^{eff}_{\tau}$ (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	4.705.04	4.045.00	200= 00		·		
<u> </u>		J201	<u> </u>	7,044	1.93E-03	0.30E-UZ	1.76E-04	1.94E-02	0.00E+00	0.00E+00	8.86E-04	6.22E-03	185
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bidg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
15	2.52E+02	0.10	8.33E+01	1.94E-02	4.00E+02	3.87E+46	1.47E-03、	3.71E-01	2.3E-05	4.9E-02	[.		

**RESULTS SHEET** 

### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	l NA	NA	7.92E+06	NA	3.5E-06	7.3E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
8.56E-01	4.14E+02	8.56E-01	7.92E+06	8.56E-01	: ] [	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

#### DATA ENTRY SHEET

GW-ADV sion 3.1; 02/04	CALCULATE RIS	SK-BASED GROU	INDWATER CONC	ENTRATION (	enter "X" in "YES" bo	): :						
Reset to		YES	OR	]								
Defaults	CALCULATE INC	CREMENTAL RIS	KS FROM ACTUAL	. GROUNDWA	TER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	indwater conc. be	elow)			
		YES	X	]								
	ENTER	ENTER										
	Chemical CAS No.	Initial groundwater conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
	67663	3.00E+00	<del>-</del>		Chloroform		· .'					
*		L				<u> </u>						: _
	ENTER	ENTER Depth	ENTER	ENTER Totals m	ENTER ust add up to value o	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined	
	groundwater temperature,	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		stratum A soil vapor	
	T _S	space floor, L _F	to water table, L _{wt}	stratum A, h _A	(Enter value or 0) h _B	(Enter value or 0)	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	İ.
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	200	200	0	0	Α	LS	LS			
	ENTED	FAITER										
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	scs	soil dry	soil total	soil water-filled
	Lookup Soil	ρ _b ^A	n ^A	θ.Α	Lookup Soil	ρ _B ^B	n ^B	θ _w ^B	soil type Lookup Soil	bulk density, Ρ _ο ^C	porosity, n ^C	porosity, θ _w ^C
	Parameters	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	LS	1.50	0.450	0.076	S	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER			
Ψ	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bldg.			
	floor thickness,	pressure differential,	floor length,	floor width	space height,	seam crack width,	air exchange rate,	,	OR eave blank to calculat	<b>Y</b> a		
	L _{crack}	ΔΡ	L _B	WB	H _B	w	ER		Q _{soil}			
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	•	(L/m)			
	10	40	1000	1000	300	0.1	0.83	]	5			
MORE +	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
	Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard quotient for						
	carcinogens,	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,			•			
	AT _C	AT _{NC}	ED	EF	TR	THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	25	25	250	1.0E-06	1	•					
END					Used to calcul							

### CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, $\theta_a^C$ (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm ³ /cm ³ )	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rp} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm ² )	Thickness of capillary zone,  L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm ³ /cm ³ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{orack} (cm)
7.88E+08	185	0.374	0.321	0.321	0.067	1.63E-08	0.964	1.57E-08	18.75	0.45	0.147	0.303	4,000
7.002700	165	0.374	1 0.321 [	0.321	1 0.007	1.032-08	1 0.504	1.57 E-08	10.75	0.45	0.147	. 0.303	4,000
Bidg. ventilation rate, Q _{bulding}	Area of enclosed space below grade, A _B	Crack- to-total area ratio, η	Crack depth below grade, Z _{crack}	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$	Henry's law constant at ave. groundwater temperature, H _{TS}	Henry's law constant at ave. groundwater temperature, H'TS	Vapor viscosity at ave. soil temperature, µтs	Stratum A effective diffusion coefficient, Deff	Stratum B effective diffusion coefficient, D ^{eff} B	Stratum C effective diffusion coefficient, D ^{eff} c	Capillary zone effective diffusion coefficient, D ^{eff} cz	Total overall effective diffusion coefficient, D ^{eff} _T	Diffusion path length, L _d
(cm ³ /s)	(cm ² )	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm ² /s)	(cm ² /s)	(cm²/s)	(cm)
6.92E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	1.94E-02	0.00E+00	0.00E+00	8.86E-04	6.22E-03	185
Convection path length, L _p (cm)	Source vapor conc., C _{source} (μg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³)·1	Reference conc., RfC (mg/m³)			
15	2.52E+02	0.10	8.33E+01	1.94E-02	4.00E+02	3.87E+46	3.61E-04 、	9.08E-02	2.3E-05	4.9E-02	1		

**RESULTS SHEET** 

### INCREMENTAL RISK CALCULATIONS:

Indoor	Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure	exposure	indoor	component	indoor		vapor	from vapor
groundwater	groundwater	exposure	water	exposure		intrusion to	intrusion to
conc	conc	groundwater	solubility	groundwater		indoor air,	indoor air,
carcinogen	noncarcinogen	conc.,	S	conc.,		carcinogen	noncarcinogen
(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)		(unitless)	(unitless)
NA	NA	NA	7.92E+06	NA	- ]	5.1E-07	1.3E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.87E+00	2.36E+03	5.87E+00	7.92E+06	5.87E+00	[	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Chuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 20

RESIDENTIAL

GW-ADV		ISK-BASED GROU	NOWATER CONC	ENTRATION (e	nter "X" in "YES" bo	ox)						
Reset to		YES	OR	]								
Defaults	CALCULATE IN	ICREMENTAL RISH	KS FROM ACTUAL	. GROUNDWAT	ER CONCENTRAT	ΠΟΝ (enter "X" in "YE	S" box and initial grou	indwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER Initial										
	Chemical CAS No.	groundwater conc.,			•							
	(numbers only, no dashes)	C _w (μg/L)	_		Chemical		•					
	79016	5.02E+00	]		Trichloroethyl	ene						
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ast add up to value	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil	<del></del>	ENTER	1
MORE ↓	Average soil/ groundwater temperature, T _S (°C)	below grade to bottom of enclosed space floor, L _F (cm)	Depth below grade to water table, L _{wt} (cm)	Thickness of soil stratum A, h _A (cm)	Thickness of soil stratum B, (Enter value or 0) h _B (cm)	Thickness of soil stratum C, (Enter value or 0) h _C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k _v (cm ² )	
	11	15	140	140	0	0	A	SL	SL			}
MORE ¥	ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density,  Pb ^A (g/cm ³ )	ENTER Stratum A soil total porosity, n ^A (unitless)	ENTER Stratum A soil water-filled porosity,  0, (cm³/cm³)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density,  pb (g/cm³)	ENTER Stratum B soil total porosity, n, ^B (unitless)	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density,  pb (g/cm³)	ENTER Stratum C soil total porosity, n ^C (unitless)	ENTER Stratum C soil water-filled porosity, ew (cm³/cm³)
	SL	1.60	0.370	0.103	S	1.66	0.375	0.054	S	1.66 ;	0.375	0.054
MORE 4	ENTER Enclosed space floor thickness,	ENTER Soil-bldg. pressure differential,	ENTER Enclosed space floor length,	ENTER Enclosed space floor width,	ENTER Enclosed space height,	ENTER Floor-wall seam crack width,	ENTER Indoor air exchange rate,	ı	ENTER Average vapor flow rate into bldg. OR eave blank to calculate	·		
	L _{crack}	ΔΡ	L _B	W _B	H _B	w	ER		Q _{soil}	-		
	(cm)	(g/cm·s²)	(cm)	(cm)	(cm)	(cm)	(1/h)	-	(L/m)			
	10	40	1000	1000	244	0.1	0.25	]	5			
MORE ↓	ENTER Averaging time for carcinogens, AT _C (yrs)	ENTER Averaging time for noncarcinogens, ATNC (yrs)	ENTER  Exposure duration, ED (yrs)	ENTER  Exposure frequency,  EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)						
	70	30	30	350	1.0E-06	T 1	1					
END	70	1 30	. 30	1 350	Used to calcu	ulate risk-based						•

### CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
	τ	Lt	θa ^A	$\theta_a^B$	$\theta_a^c$	S _{te}	k _i	k _{rg}	· k _v	L _{cz}	n _{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X _{crack}
_	(sec)	(cm)	(cm ³ /cm ³ )	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm)
_								1				1 0 050	0.000	1 4000
Ļ	9.46E+08	125	0.267	0.321	0.321	0.193	5.94E-09	0.895	5.32E-09	25.00	0.37	0.050	0.320	4,000
	Bldg. ventilation rate,	Area of enclosed space below grade,	Crack- to-total area ratio,	Crack depth below grade,	Enthalpy of vaporization at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Henry's law constant at ave. groundwater temperature,	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient,	Stratum B effective diffusion coefficient,	Stratum C effective diffusion coefficient,	Capillary zone effective diffusion coefficient,	Total overall effective diffusion coefficient, D ^{eff} _T	Diffusion path length,
	Q _{building}	AB	. η	$Z_{crack}$	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	μτς	D ^{eff} _A	D ^{eff} _B	D ^{eff} c	D ^{eff} cz	•	La
٠.	(cm³/s)	(cm²)	(unitless)	(cm)	(cai/mol)	(atm-m³/mol)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	7.10E-03	0.00E+00	0.00E+00	3.42E-05	1.68E-04	125
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitiess)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg, conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
	15	1.09E+03	0.10	8.33E+01	7.10E-03	4.00E+02	2.28E+127	8.26E-05	8.98E-02	1.1E-04	3.5E-02	1	•	

RESULTS SHEET

#### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	]	4.1E-06	2.5E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

**PRG SHEET** 

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.24E+00	2.04E+03	1.24E+00	1.47E+06	1.24E+00	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV ersion 3.1; 02/04	CALCULATE RI	SK-BASED GROU	NDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	ox)	•					
		YES		כ								
Reset to Defaults			OR									
Deladits	CALCULATE IN	CREMENTAL RISI	KS FROM ACTUAL	. GROUNDWA1	ER CONCENTRAT	FION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER					·					
	Chemical	initial groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)			Chemical							
			<u> </u>		Chemical							
	79016	5.02E+00	_		Trichloroethyl	ene						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	
MORE	Average	Depth below grade		Totals mu	st add up to value				Soil			
	soil/	to bottom	Depth	Thickness	of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	*
	groundwater temperature,	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
	T _S	space floor, L _f	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	140	140	0	0	A	SL	SL	1		
	<u> </u>		1 140	140	· · · · · · · · · · · · · · · · · · ·		L2	<u> </u>	]SL			
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	Stratum B	Stratum C	Stratum C	Stratum C	Stratum C
<u> </u>	SCS soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,	SCS soil type	soil dry bulk density,	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled
				θ _w ^A		ρ _b ⁸	porosity, n ^B	porosity, ' θ _ω ^B	Soil type	bulk density, Ρь ^C	porosity, n ^C	porosity, θ _w c
	Lookup Soil	0. ^A	n"									
	Lookup Soil Parameters	ρ _ь ^A (g/cm³)	n ^A (unitless)		Lookup Soil Parameters			••	Parameters			
	Parameters	(g/cm ³ )	(unitless)	(cm ³ /cm ³ )	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	Parameters	(g/cm³)						••				
MORE	Parameters  SL  ENTER	(g/cm ³ )	(unitless)  0.370  ENTER	(cm³/cm³) 0.103 ENTER	Parameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters S ENTER	(g/cm³)	(unitless)	(cm³/cm³)
MORE ↓	Parameters	(g/cm³)	(unitless)  0.370  ENTER Enclosed	(cm³/cm³)  0.103  ENTER Enclosed	Parameters S ENTER	(g/cm ³ )	(unitless) 0.375 ENTER	(cm³/cm³)	S ENTER Average vapor	(g/cm³)	(unitless)	(cm³/cm³)
MORE V	ENTER Enclosed space floor	(g/cm³)  1.60  ENTER  Soil-bldg. pressure	(unitless)  0.370  ENTER Enclosed space floor	(cm³/cm³)  0.103  ENTER Enclosed space floor	Parameters  S  ENTER  Enclosed space	(g/cm³)  1.66  ENTER  Floor-wall seam crack	(unitless) 0.375	(cm³/cm³)	Parameters S ENTER	(g/cm³)	(unitless)	(cm³/cm³)
MORE V	ENTER Enclosed space floor thickness,	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential,	(unitless)  0.370  ENTER Enclosed space floor length,	(cm³/cm³)  0.103  ENTER Enclosed space floor width,	S ENTER Enclosed space height,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width,	(unitless)  0.375  ENTER  Indoor air exchange rate,	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE ↓	SL  ENTER Enclosed space floor thickness, Lerack	(g/cm³)  1.60  ENTER  Soil-bidg. pressure differential, ΔP	(unitless)  0.370  ENTER Enclosed space floor length, La	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B	S ENTER Enclosed space height, H ₈	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	(unitless)  0.375  ENTER Indoor air exchange rate, ER	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE U	ENTER Enclosed space floor thickness,	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential,	(unitless)  0.370  ENTER Enclosed space floor length,	(cm³/cm³)  0.103  ENTER Enclosed space floor width,	S ENTER Enclosed space height,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width,	(unitless)  0.375  ENTER  Indoor air exchange rate,	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE ↓	SL  ENTER Enclosed space floor thickness, Lerack	(g/cm³)  1.60  ENTER  Soil-bidg. pressure differential, ΔP	(unitless)  0.370  ENTER Enclosed space floor length, La	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B	S ENTER Enclosed space height, H ₈	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	(unitless)  0.375  ENTER Indoor air exchange rate, ER	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	SL ENTER Enclosed space floor thickness, Lerack (cm) 10 ENTER	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER	(unitless)  0.370  ENTER Enclosed space floor length, L _B (cm)	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)	S ENTER Enclosed space height, H _B (cm)	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
	ENTER Enclosed space floor thickness, Lereck (cm)  ENTER Averaging	(g/cm³)  1.60  ENTER  Soil-bidg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging	(unitless)  0.370  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER	Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for	(unitless)  0.370  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER Exposure	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER  Exposure	Parameters  S ENTER Enclosed space height, He (cm)  244 ENTER Target risk for	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	SL ENTER Enclosed space floor thickness, Lerack (cm)  ENTER Averaging time for carcinogens,	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens,	(unitless)  0.370  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	(cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER	Parameters  S ENTER Enclosed space height, Hs (cm)  244 ENTER Target risk for carcinogens,	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for	(unitless)  0.370  ENTER Enclosed space floor length, Le (cm)  1000  ENTER  Exposure duration,	(cm³/cm³)  0.103  ENTER Enclosed space floor width, Ws (cm)  1000  ENTER  Exposure frequency,	Parameters  S ENTER Enclosed space height, He (cm)  244 ENTER Target risk for	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	(unitless)  0.370  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER Exposure duration, ED (yrs)	(cm³/cm³)  0.103  ENTER Enclosed space floor width, Ws (cm)  1000  ENTER  Exposure frequency, EF (days/yr)	Parameters  S ENTER Enclosed space height, He (cm)  244 ENTER Target risk for carcinogens, TR (unitless)	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	SL  ENTER Enclosed space floor thickness, Lereck (cm)  10  ENTER Averaging time for carcinogens, ATc	(g/cm³)  1.60  ENTER  Soil-bidg, pressure differential, $\Delta P$ (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$	(unitless)  0.370  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	(cm³/cm³)  0.103  ENTER Enclosed space floor width, Ws (cm)  1000  ENTER Exposure frequency, EF	Parameters  S ENTER  Enclosed space height, He (cm)  244  ENTER Target risk for carcinogens, TR	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)
MORE	ENTER Enclosed space floor thickness, Lerack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	(g/cm³)  1.60  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	(unitless)  0.370  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER Exposure duration, ED (yrs)	(cm³/cm³)  0.103  ENTER Enclosed space floor width, Ws (cm)  1000  ENTER  Exposure frequency, EF (days/yr)	Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens, TR (unitless) 1.0E-06 Used to calcu	(g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	(unitless)  0.375  ENTER  Indoor air exchange rate, ER (1/h)	(cm³/cm³) 0.054	S ENTER Average vapor flow rate into bidg. OR eave blank to calcula Q _{toll} (L/m)	(g/cm ³ ) 1,66	(unitless)	(cm³/cm³)

### CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^{\ B}$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm ² )	Thickness of capillary zone,  L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
	9.46E+08	125	0.267	0.321	0.321	0.193	5.94E-09	0.895	5.32E-09	25.00	0.37	0.050	0.320	4,000
	Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'Ts	Vapor viscosity at ave. soil temperature, µrs (g/cm-s)	Stratum A effective diffusion coefficient D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} ₉ (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deff cz (cm²/s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	7.10E-03	0.00E+00	0.00E+00	3.42E-05	1.68E-04	125
_	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm³/s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bidg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ¹	Reference conc., RfC (mg/m³)			
	15 END	1.09E+03	0.10	8.33E+01	7.10E-03	4.00E+02	2.28E+127	8.26E-05、	8.98E-02	2.0E-06	6.0E-01			

**RESULTS SHEET** 

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

**INCREMENTAL RISK CALCULATIONS:** 

Indoor	Indoor	Risk-based	Pure	Final	Incremental risk from	Hazard quotient
exposure	exposure	indoor	component	indoor	vapor	from vapor intrusion to indoor air,
groundwater	groundwater	exposure	water	exposure	intrusion to	
conc	conc	groundwater	solubility,	groundwater	indoor air,	
carcinogen	noncarcinogen	conc.,	S	conc.,	carcinogen	noncarcinogen
(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(unitless)	(unitless)
NA .	NA NA	NA NA	1.47E+06	NA	7.4E-08	1.4E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
6.80E+01	3.50E+04	6.80E+01	1.47E+06	6.80E+01	l [	NA	NA I

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

GW-ADV ersion 3.1; 02/04	CALCULATE R	ISK-BASED GROUI	NDWATER CONC	CENTRATION (e	nter "X" in "YES" b	ox)						
Reset to		YES	OR	]								
Defaults	CALCULATÉ IN	ICREMENTAL RISK	S FROM ACTUA	L GROUNDWAT	TER CONCENTRA	TION (enter "X" in "YE	S" box and initial grou	indwater conc. be	low)			
		YES	X	],				*				
	ENTER Chemical	ENTER Initial										
	CAS No. (numbers only,											
	no dashes)	(μg/L)	•		Chemical	<del> </del>	•					
	79016	5.02E+00	] .		Trichloroethyl	ene	]					
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ist add up to value	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	]
MORE	Average soil/ groundwater temperature, T _s	below grade to bottom of enclosed space floor, L _F (cm)	Depth below grade to water table, L _W T	Thickness of soil stratum A,	Thickness of soil stratum B, (Enter value or 0) h _B	h _C	Soil stratum directly above water table.	SCS soil type directly above	stratum A SCS soil type (used to estimate soil vapor	OR	User-defined stratum A soil vapor permeability, k _v	
			(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	•
	11	15	140	140	0	0	Α	SL	SL			)
MORE +	ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, $\rho_b^A$ (g/cm³)	ENTER Stratum A soil total porosity, n ^A (unitless)	ENTER Stratum A soil water-filled porosity, θ _w ^A (cm ³ /cm ³ )	Stratum B SCS Soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, $\rho_b^B$ (g/cm 3 )	ENTER Stratum B soil total porosity, n ⁸ (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w^B$ $(cm^3/cm^3)$	ENTER Stratum C SCS Soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density,  p _b ^C (g/cm ³ )	ENTER Stratum C soil total porosity, n ^C (unitless)	ENTER Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	SL	1.60	0.370	0.103	S	1.66	0.375	0.054	S	1.66	0.375	0.054
MORE	ENTER Enclosed space	ENTER Soil-bidg.	ENTER Enclosed space	ENTER Enclosed space	ENTER Enclosed	ENTER Floor-wall	ENTER		ENTER Average vapor flow rate into bldg.		• *	
L	floor thickness, L _{crack}	pressure differential, ΔΡ	floor length, L ₈	floor width, W ₈	space height, H _B	seam crack width w	air exchange rate, ER	L	OR eave blank to calculat Q _{soil}	te		
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)	_	(L/m)			
	10	40	1000	1000	300	0.1	0.83	]	5			
MORE .	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard						
	time for carcinogens,	time for noncarcinogens, AT _{NC}	Exposure duration, ED	Exposure frequency, EF	risk for carcinogens, TR	quotient for noncarcinogens, THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
END	70	25	25	250		late risk-based	are Salan Taran					
ENU					groungwater	concentration.						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³ ) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm ³ /cm ³ )	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a ^c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	125	0.267	0.321	0.321	0.193	5.94E-09	0.895	5.32E-09	25.00	0.37	0.050	0.320	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  Hrs (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H*Ts (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{cz} (cm ² /s)	Total overall effective diffusion coefficient, Deff (cm²/s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	7.10E-03	0.00E+00	0.00E+00	3.42E-05	1.68E-04	. 125
Convection path length,	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient α (unitless)	Infinite source bidg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ¹	Reference conc., RfC (mg/m³)	5.22.00	1.052-04	
(cm)	(µg/iii)	12.1.1	·····						A STATE OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PAR				

### **RESULTS SHEET**

## RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	 5.9E-07	4.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
8.48E+00	1.17E+04	8.48E+00	1.47E+06	8.48E+00	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

GW-ADV ersion 3.1; 02/		RISK-BASED GRO	UNDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	ox)						
Reset to		YES	OR	]								
Defaults	CALCULATE	INCREMENTAL RIS	SKS FROM ACTUAL	GROUNDWAT	TER CONCENTRAT	TION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER Initial										
	Chemical CAS No.	groundwater conc.,										
	(numbers on no dashes)	ly, C _w			Chemical							
	79016	5.02E+00	<del>-</del>		Trichloroethyl	ene	• 1					
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	I ENTER	ENTER	ENTER .		ENTER	1
MORI	Average	Depth below grade		Totals mu	ust add up to value Thickness	of L _{w1} (cell G28) Thickness			Soil stratum A		User-defined	
<u> </u>	soil/ groundwate		Depth below grade	Thickness of soil	of soil stratum B;	of soil stratum C,	Soil stratum	scs	SCS soil type	05	stratum A soil vapor	
	temperature T _S	L _F	to water table, L _{wt}	stratum A, h _A	(Enter value or 0)	h _c	directly above water table,	soil type directly above	(used to estimate soil vapor	OR	permeability, k _v	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)	r i	(cm²)	
	11	15	140	140	0	0	Α	SL	SL		L	
MORI	SCS soil type	ENTER Stratum A soil dry bulk density,	ENTER Stratum A soil total porosity, n ^A	ENTER Stratum A soil water-filled porosity,	soil type	ENTER Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity,  QB	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density,	ENTER Stratum C soil total porosity, n ^C	ENTER Stratum C soil water-filled porosity, $\theta_w^C$
	Lookup Soil Parameters	ρ _ь ^A (g/cm³)	(unitless)	θ <b>"^A</b> (cm³/cm³)	Lookup Soil Parameters	ρ _ь ⁸ (g/cm³)	Q (unitless)	θ _w ^B (cm³/cm³)	Lookup Soil Parameters	ρ _ь с (g/cm³)	(unitiess)	(cm³/cm³)
	SL	1.60	0.370	0.103	S	1.66	0.375	0.054	s	1.66	0.375	0.054
MORI	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER Average vapor			
4	space floor	Soil-bldg. pressure	space	space floor	Enclosed space	Floor-wall seam crack	Indoor air exchange	,	flow rate into bldg. OR			
	thickness, L _{crack}	differential, ΔP	length, L _B	width, W _B	height, H ₈	width, w	rate, ER	۱.	eave blank to calcula Q _{soil}	te		
	(cm)	(g/cm-s ² )	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)			
	10	40	1000	1000	300	0.1	0.83	]	.5			
MOR! ↓	Averaging	ENTER Averaging	ENTER	ENTER	ENTER Target	ENTER Target hazard						
	time for carcinogens			Exposure frequency,	risk for carcinogens,	quotient for noncarcinogens,						
	AT _C (yrs)	AT _{NC} (yrs)	ED (yrs)	EF (days/yr)	TR (unitless)	THQ (unitless)					-	
	70	25	25	250	1.0E-06	1						
END	<del>-</del>			v		ulate risk-based r concentration.						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm²/s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, θ _a ^B (cm ³ /cm ³ )	Stratum C soil air-filled porosity, $\theta_a^{\ C}$ (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone,  L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
							1		05.00		0.050	0.320	4,000
7.88E+08	125	0.267	0.321	0.321	0.193	5.94E-09	0.895	5.32E-09	25.00	0.37	0.050	0.320	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} ₈ (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm²/s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	7.10E-03	0.00E+00	0.00E+00	3.42E-05	1.68E-04	125
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe ^t ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³)·1	Reference conc., RfC (mg/m³)			
15	1.09E+03	0.10	8.33E+01	7.10E-03	4.00E+02	2.28E+127	2.02E-05	2.20E-02	2.0E-06	6.0E-01	J		

## **RESULTS SHEET**

# RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

## **INCREMENTAL RISK CALCULATIONS:**

	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
[	NA	NA NA	NA	1.47E+06	NA	1.1E-08	2.5E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### **INCREMENTAL RISK CALCULATIONS:**

indoor exposure groundwater conc., carcinogen	Indoor exposure groundwater conc., noncarcinogen	Risk-based indoor exposure groundwater conc.,	Pure component water solubility, S	Final indoor exposure groundwater conc.,	Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(unitless)	(unitless)
4.67E+02	2.00E+05	4.67E+02	1.47E+06	4.67E+02	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

SITE 23

RESIDENTIAL

#### DATA ENTRY SHEET

GW-ADV sion 3.1; 02/04	CALCULATE RIS	K-BASED GROUP	NDWATER CONC	ENTRATION (e	nter "X" in "YES" bo	<b>x</b> )						÷
Reset to Defaults		YES	OR	]								
Beladits	CALCULATE INC	REMENTAL RISK	S FROM ACTUAL	L GROUNDWAT	ER CONCENTRAT	ION (enter "X" in "YE	S" box and initial grou	indwater conc. be	low)			
		YES	X	]								
	ENTER	ENTER Initial										
	Chemical CAS No.	groundwater conc.										
	(numbers only,	Cw										
	no dashes)	(µg/L)		*	Chemical	**************************************						
	67663	3.00E+00	]		Chloroform							
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ist add up to value of	ENTER	ENTER	ENTER	ENTER Soil	· · ·	ENTER	
MORE	Average	below grade			Thickness	Thickness			stratum A		User-defined	
<u> </u>	soil/ groundwater	to bottom of enclosed	Depth	Thickness	of soil	of soil	Soil		scs		stratum A	·
	temperature,	space floor,	below grade to water table,	of soil stratum A,	stratum B, (Enter value or 0)	stratum C, (Enter value or 0)	stratum directly above	SCS soil type	soil type (used to estimate	OR	soil vapor permeability.	
	Ts	Le	L _{W7}	h _A	h _B	h _c	water table,	directly above	soil vapor	OK	k,	ł
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
				1					·	-		1
	11	15	210	210	٥			61	ei -	7		
	11	15	210	210	0	0	A	SL	SL	1		
	ENTER	15 ENTER								ENTER	EMTEO	ENTED
MORE	ENTER Stratum A	ENTER Stratum A	210 ENTER Stratum A	210  ENTER Stratum A	0 ENTER Stratum B	0 ENTER Stratum B	A ENTER Stratum B	SL ENTER Stratum B	SL ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
MORE +	ENTER Stratum A SCS	ENTER Stratum A soil dry	ENTER Stratum A soil total	ENTER Stratum A soil water-filled	ENTER Stratum B SCS	ENTER Stratum B soil dry	ENTER Stratum B soil total	ENTER Stratum B soil water-filled	ENTER Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
	ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density,	ENTER Stratum A soil total porosity,	ENTER Stratum A soil water-filled porosity,	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity,	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
	ENTER Stratum A SCS	ENTER Stratum A soil dry bulk density, \$\rho_{\rho}^{\rho}\$	ENTER Stratum A soil total porosity, n ^A	ENTER Stratum A soil water-filled porosity,  0,4	ENTER Stratum B SCS	ENTER Stratum B soil dry bulk density, $\rho_b^B$	ENTER Stratum B soil total porosity, n ^B	ENTER Stratum B soil water-filled porosity,  0,8	ENTER Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\ C}$
	ENTER Stratum A SCS SOil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density,	ENTER Stratum A soil total porosity,	ENTER Stratum A soil water-filled porosity,	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density,	ENTER Stratum B soil total porosity,	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
	ENTER Stratum A SCS soil type Lookup Soil	ENTER Stratum A soil dry bulk density, \$\rho_{\rho}^{\rho}\$	ENTER Stratum A soil total porosity, n ^A	ENTER Stratum A soil water-filled porosity,  0,4	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, $\rho_b^{\ B}$	ENTER Stratum B soil total porosity, n ^B	ENTER Stratum B soil water-filled porosity,  0,8	ENTER Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\mathbf{C}}$
	ENTER Stratum A SCS SOil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, \$\rho_b^A^{\text{(g/cm}^3)}\$	ENTER Stratum A soil total porosity, n ^A (unitless)	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, $ ho_b^{\ B}$ (g/cm³)	ENTER Stratum B soil total porosity, n ⁸ (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters S ENTER	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space	ENTER Stratum A soil dry bulk density, pb^ (g/cm³)  1.50  ENTER  Soil-bldg.	ENTER Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed space	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103  ENTER Enclosed space	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, $ ho_b^{\ B}$ (g/cm ³ )	ENTER Stratum B soil total porosity, n ^B (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
<b>₩</b> ORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	ENTER Stratum A soil dry bulk density, pb ^A (g/cm ³ )  1.50  ENTER  Soil-bldg. pressure	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor	ENTER Stratum A soil water-filled porosity, 0," (cm³/cm³)  0.103  ENTER Enclosed space floor	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space	ENTER Stratum B soil dry bulk density, \$\rho_b^B\right(g/cm^3)\right)  1.66  ENTER  Floor-wall seam crack	ENTER Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
<b>₩</b> ORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness,	ENTER Stratum A soil dry bulk density, p,^ (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential,	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length,	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103  ENTER Enclosed space floor width,	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	ENTER Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate,	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lockup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR gave blank to calcula	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
<b>₩</b> ORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	ENTER Stratum A soil dry bulk density, pb ^A (g/cm ³ )  1.50  ENTER  Soil-bldg. pressure	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor	ENTER Stratum A soil water-filled porosity, 0," (cm³/cm³)  0.103  ENTER Enclosed space floor	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	ENTER Stratum B soil dry bulk density, $\rho_b^B$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
<b>₩</b> ORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (Cm)	ENTER Stratum A soil dry bulk density, p ₀ ^A (g/cm ³ )  1.50  ENTER  Soil-bldg pressure differential, ΔP (g/cm-s ² )	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	ENTER Stratum A soil water-filled porosity, e," (cm³/cm³)  0.103  ENTER Enclosed space floor width, We (cm)	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	ENTER Stratum B soil dry bulk density, \$\rho_b^B\\ (g/cm^3)  1.66  ENTER  Floor-wall seam crack width, w (cm)	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE U	ENTER Stratum A SCS soll type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)	ENTER Stratum A soil dry bulk density, ph^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L8	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	ENTER Stratum B soil dry bulk density, $\rho_b^B$ (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w	ENTER Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange rate, ER	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calcula	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER	ENTER Stratum A soil dry bulk density, p,5 (g/cm³)  1.50  ENTER  Soil-bldg pressure differential, ΔP (g/cm-s²)  40  ENTER	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	ENTER Stratum A soil water-filled porosity, e," (cm³/cm³)  0.103  ENTER Enclosed space floor width, We (cm)	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER	ENTER Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE U	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, L-vack (cm)  10 ENTER Averaging	ENTER Stratum A soil dry bulk density, pb^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L ₈ (cm)  1000  ENTER	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target	ENTER Stratum B soil dry bulk density, \$\rho_b^8\$ (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for	ENTER Stratum A soil dry bulk density, p,5 (g/cm³)  1.50  ENTER  Soil-bldg pressure differential, ΔP (g/cm-s²)  40  ENTER	ENTER Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	ENTER Stratum A soil water-filled porosity, θ, (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Enclosed Space	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)  244  ENTER Target risk for	ENTER Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for carcinogens, ATc	ENTER Stratum A soil dry bulk density, p _b ^A (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{ICC}	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	ENTER Stratum A soil water-filled porosity, 0, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Exposure frequency, EF	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)  244  ENTER Target risk for carcinogens, TR	ENTER Stratum B soil dry bulk density, \$\rho_b^B\\ (g/cm^3)\$  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens.	ENTER Stratum A soil dry bulk density, ps^ (g/cm³)  1.50  ENTER  Soil-bldg pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens,	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration,	ENTER Stratum A soil water-filled porosity, e,,,,,,, (cm³/cm³)  0.103  ENTER Enclosed space floor width, We (cm)  1000  ENTER  Exposure frequency,	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)  244  ENTER Target risk for carcinogens,	ENTER Stratum B soil dry bulk density, \$\rho_{\theta}^{9}\$ (g/cm^{3})  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotlent for noncarcinogens,	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for carcinogens, ATc	ENTER Stratum A soil dry bulk density, p _b ^A (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{ICC}	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED	ENTER Stratum A soil water-filled porosity, 0, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Exposure frequency, EF	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)  244  ENTER Target risk for carcinogens, TR	ENTER Stratum B soil dry bulk density, \$\rho_b^B\\ (g/cm^3)\$  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$
MORE WORE	ENTER Stratum A SCS soll type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	ENTER Stratum A soil dry bulk density, ps^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	ENTER Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Le (cm)  1000  ENTER  Exposure duration, ED (yrs)	ENTER Stratum A soil water-filled porosity,	ENTER Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	ENTER Stratum B soil dry bulk density, \$\rho_b^B\$ (g/cm^3)  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	ENTER Stratum B soil water-filled porosity, θ ^B (cm ³ /cm ³ )	ENTER Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR save blank to calcula Qsoil (L/m)	Stratum C soil dry bulk defansity, \$\rho_b^C\$ \(\langle g/cm^3\rangle\)	Straturn C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^{C}$ $(cm^3/cm^3)$

## CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
(222)	L ₇	θ _a ^A (cm ³ /cm ³ )	θ _a ^B (cm³/cm³)	θ _ε ^C (cm³/cm³)	S _{te} (cm³/cm³)	k _i	k _{rg}	k _v	L _{cz}	n _{cz}	θ _{a,cz}	θ _{w,cz}	X _{crack}
(sec)	(cm)	(cm /cm )	(cm·/cm·)	(cm²/cm²)	(cm²/cm²)	(cm²)	(cm²)	(cm ² )	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
9.46E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
Bidg. ventilation rate, Q _{bulding} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature,  H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'1s (unitless)	Vapor viscosity at ave. soil temperature, µrs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm²/s)	Stratum B effective diffusion coefficient, Deff _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _T (cm ² /s)	Diffusion path length, L _d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	1.51E-02	0.00E+00	0.00E+00	5.93E-04	3.65E-03	195
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{creck} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³)-¹	Reference conc., RfC (mg/m³)			
15	2.52E+02	0.10	8.33E+01	1.51E-02	4.00E+02	6.17E+59	9.46E-04、	2.38E-01	2.3E-05	4.9E-02	] .		

**RESULTS SHEET** 

### INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen	Indoor exposure groundwater conc., noncarcinogen	Risk-based indoor exposure groundwater conc.,	Pure component water solubility, S	Final indoor exposure groundwater conc.,	Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, noncarcinogen
(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(unitless)	(unitless)
NA	NA	NA	7.92E+06	NA	2.2E-06	4.7E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.33E+00	6.44E+02	1.33E+00	7.92E+06	1.33E+00	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Chuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

GW-ADV CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box) Version 3.1; 02/04 YES Reset to OR Defaults CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below) YES X **ENTER** ENTER Initial Chemical groundwater CAS No. conc., (numbers only, Cw Chemical no dashes) (μg/L) 79016 5.00E-01 Trichloroethylene ENTER ENTER **ENTER** ENTER ENTER ENTER **ENTER ENTER ENTER** ENTER Depth Totals must add up to value of LwT (cell G28) Soil User-defined MORE Average below grade Thickness Thickness stratum A SCS stratum A Depth Soil soil/ to bottom Thickness of soil of soil soil vapor groundwater of enclosed below grade of soil stratum B, stratum C, stratum SCS soil type (Enter value or 0) directly above soil type (used to estimate OR permeability, (Enter value or 0) temperature. space floor, to water table. stratum A. hA water table, directly above soil vapor  $T_{S}$ LF Lwt he hc (°C) (cm²) (cm) (cm) (cm) (Enter A, B, or C) water table permeability) (cm) (cm) 11 15 210 210 0 0 SL SI ENTER **ENTER** ENTER ENTER ENTER ENTER ENTER **ENTER** ENTER ENTER ENTER ENTER Stratum C Stratum C Stratum C MORE Stratum A Stratum A Stratum A Stratum B Stratum B Stratum B Stratum B Stratum C Stratum A soil total soil water-filled SCS soil water-filled T. soil water-filled SCS soil dry soil dry soil total SCS soil dry soil total bulk density, porosity, soil type bulk density, porosity, porosity, soil type bulk density, porosity, porosity, soil type porosity, θ**"**C  $\rho_b^C$ nC  $\rho_b^{-8}$  $\rho_b^A$ · n^A θ_w^ Lookup Soil Lookuo Soil Lookup Soil Parameters Parameters (cm³/cm³) (g/cm3) (cm³/cm³) (g/cm³) (cm³/cm³) (g/cm³) (unitless) (unitless) (unitless) 0.054 1.66 0.375 0.054 SL 1.50 0.450 0.103 s 1.66 0.375 S ENTER ENTER ENTER **ENTER ENTER ENTER ENTER** ENTER Average vapor MORE Enclosed Enclosed Enclosed 4 Soil-bldg. Enclosed Floor-wall Indoor flow rate into bldg. space space Space OR floor pressure floor floor space seam crack air exchange differential, height, width, rate, Leave blank to calculate thickness, length, width. ΔΡ LB  $W_B$ HB w ΕR Q_{soil} (g/cm-s2) (cm) (cm) (1/h) (L/m) (cm) (cm) (cm) 244 0.1 0.25 5 10 40 1000 1000 MORE **ENTER** ENTER ENTER **ENTER ENTER** ENTER ¥ Averaging Target Target hazard Averaging time for time for Exposure Exposure risk for quotient for noncarcinogens, noncarcinogens, duration. carcinogens, carcinogens, frequency, ATc ATNC ED EF TR THQ (unitiess) (unitless) (yrs) (yrs) (yrs) (days/yr) 70 30 30 350 1.0E-06 Used to calculate risk-based END groundwater concentration.

## CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m ³ )
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

T	Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
Area of enclosed Crack-enclosed convention below area below are groundwater rate, grade, (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²/s)   (cm²	τ	•	θ,Α	$\theta_a^B$	$\theta_a^C$	S _{te}	<b>k</b> i 2.	k _{rg}	· .		n _{cz}	$\theta_{a,cz}$	θ _{w,cz}	X _{crack}
Area of enclosed Crack- Crack Enthalpy of enclosed constant at constant at viscosity at effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effective effecti	(sec)	(cm)	(cm²/cm²)	(cm³/cm³)	(cm²/cm²)	(cm³/cm³)	(cm²)	(cm²)	(cm²)	(cm)	(cm²/cm²)	(cm²/cm²)	(cm²/cm²)	(cm)
Bildg. space to-total depth space to-total below area below area (constant at vac. groundwater rate, prate, (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (cm²/s) (	9.46E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
(cm³/s)         (cm²)         (unitless)         (cm)         (cal/mol)         (atm-m³/mol)         (unitless)         (g/cm-s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)         (cm²/s)	ventilation	enclosed space below	to-total area	depth below	vaporization at ave. groundwater	constant at ave. groundwater	constant at ave. groundwater	viscosity at ave. soil	A effective diffusion	B effective diffusion coefficient,	C effective diffusion coefficient,	zone effective diffusion coefficient,	overall effective diffusion coefficient,	path
1.69E+04   1.06E+06   3.77E-04   15   8,544   5.05E-03   2.17E-01   1.76E-04   1.15E-02   0.00E+00   0.00E+00   4.45E-04   2.75E-03   195    Exponent of equivalent source Infinite source Infinite source Unit path vapor Crack flow rate diffusion Area of Peclet attenuation bldg. risk Reference length, conc., radius, into bldg., coefficient, crack, number, coefficient, conc., Lp C _{source} r _{crack} Q _{soll} D ^{crack} A _{crack} exp(Pef) α C _{butding} URF RfC (cm) (μg/m³) (cm) (cm³/s) (cm²/s) (cm²) (unitless) (unitless) (μg/m³) (μg/m³) (mg/m³)			η	$Z_{crack}$	$\Delta H_{v,TS}$	17	H' _{TS}	μτς	. ~	_ <del>-</del>	•			La
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/mol)	(unitiess)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
Average Crack equivalent source Infinite  Convection Source vapor effective foundation indoor source Unit  path vapor Crack flow rate diffusion Area of Peclet attenuation bldg. risk Reference  length, conc., radius, into bldg., coefficient, crack, number, coefficient, conc., factor, conc., $L_p$ $C_{source}$ $r_{crack}$ $Q_{soil}$ $D^{crack}$ $A_{crack}$ $exp(Pe^f)$ $\alpha$ $C_{building}$ URF RfC  (cm) $(\mu g/m^3)$ (cm) $(cm^3/s)$ $(cm^2/s)$ $(cm^2)$ $(unitless)$ $(unitless)$ $(\mu g/m^3)$ $(\mu g/m^3)^{-1}$ $(mg/m^3)$	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	1.15E-02	0.00E+00	0.00E+00	4.45E-04	2.75E-03	195
15   1.08E+02   0.10   8.33E+01   1.15E-02   4.00E+02   5.15E+78   7.47E-04   8.09E-02   1.1E-04   3.5E-02	path length, L _p	vapor conc., C _{source}	radius, r _{crack}	vapor flow rate into bldg., Q _{soil}	effective diffusion coefficient, D ^{crack}	crack, A _{crack}	equivalent foundation Peclet number, exp(Pe ^f )	source indoor attenuation coefficient, α	source bldg. conc., C _{building}	risk factor, URF	conc., RfC			
	15	1.08E+02	0.10	8.33E+01	1.15E-02	4.00E+02	5.15E+78	7.47E-04	8.09E-02	1.1E-04	3.5E-02	1		

**RESULTS SHEET** 

# INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	 3.7E-06	2.2E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

PRG SHEET

#### **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.37E-01	2.26E+02	1.37E-01	1.47E+06	1.37E-01	• 	NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04	CALCULATE RE	SK-BASED GROU	NDWATER CON	CENTRATION (e	enter "X" in "YES" bo	ox)						
		YES		]								
Reset to Defaults			OR									
Delaults	CALCULATE IN	CREMENTAL RISK	S FROM ACTUA	L GROUNDWA	TER CONCENTRAT	TON (enter "X" in "YE	S" box and initial grou	undwater conc. be	elow)			
		YES	X	7								
		•	<del></del>									
	ENTER	ENTER Initial										
	Chemical	groundwater										
	CAS No.	conc.,										
	(numbers only, no dashes)	C _w (μg/L)		* *	Chemical							
			<b>-</b>		Chemical		•					
	79016	5.00E-01	]		Trichloroethyle	ene						
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	· · · · · · · · · · · · · · · · · · ·	ENTER	ľ
MORE	Average	Depth below grade		Totals mu	ist add up to value o		7		Soil			
<u> </u>	soil/	to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A		User-defined	
	groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	SCS soil type		stratum A soil vapor	
	temperature, T _s	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR .	permeability,	
	's (℃)	L _F	Lwt	h _A	h _B	hc	water table,	directly above	soil vapor		k _v	
	(0)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
	11	15	210	210	0	0	A	SL	SL	!		
								·	·			
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	FNTER	ENTER	ENTED	ENTER	CHTED	
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
MORE ↓	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	ENTER Stratum C SCS	ENTER Stratum C soil dry	ENTER Stratum C soil total	ENTER Stratum C soil water-filled
	Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity
	Stratum A SCS	Stratum A soil dry bulk density, Pb ^A	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density, Pb ^B	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total	Stratum C soil water-filled
	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity
	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb ^A	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density, Pb ^B	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^B$	Stratum C SCS soil type	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^C$
	Stratum A SCS Soil type Lookup Soil Parameters  SL ENTER	Stratum A soil dry bulk density, Pb ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm ³ /cm ³ )	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $ ho_b^B$ (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS Soil type Lookup Soil Parameters	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed	Stratum A soil dry bulk density, p _b ^A (g/cm³) 1,50	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed	Stratum A soil water-filled porosity. $\theta_w^A$ (cm³/cm³)  0.103  ENTER Enclosed	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b B (g/cm³)  1.66  ENTER	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space	Stratum A soil dry bulk density, p _b ^A (g/cm³)  1.50  ENTER  Soil-bldg.	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed space	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER	Stratum B soil total porosity, nB (unitless) 0.375 ENTER	Stratum B soil water-filled porosity, $\theta_w^B$ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg.	Stratum C soil dry bulk density, $ ho_b^C$ (g/cm³)	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed	Stratum A soil dry bulk density, p _b ^A (g/cm³) 1,50	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed	Stratum A soil water-filled porosity. $\theta_w^A$ (cm³/cm³)  0.103  ENTER Enclosed	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space	Stratum B soil dry bulk density, p B (g/cm³)  1.66 ENTER  Floor-wall seam crack	Stratum B soil total porosity, n ⁸ (unitless)  0.375  ENTER Indoor air exchange	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor	Stratum A soil dry bulk density, ps (g/cm³)  1.50  ENTER  Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor	Stratum A soil water-filled porosity, θ, Λ (cm³/cm³)  0.103  ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER	Stratum B soil total porosity, nB (unitless) 0.375 ENTER	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS Soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculate	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Pb ^A (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, \$\theta_w^A\$ (cm^3/cm^3)  O.103  ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, p _b ^B (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless) 0.375 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS Soil type Lookup Soil Parameters SL ENTER Enclosed space floor thickness, L-crack	Stratum A soil dry bulk density, Ps^ (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled poosity, 9,4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE +	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-rack (cm)	Stratum A soil dry bulk density, Pb ^A (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, e.g., (cm ³ /cm ³ )  0.103  ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS soil type Lookup Soil parameters  S ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, pB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)	Stratum B soil total porosity, n ^B (unitless) 0,375  ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR eave blank to calculat	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
. ↓ MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lerack (cm)  10 ENTER	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled poosity, 9,4 (cm³/cm³) 0.103   ENTER Enclosed space floor width, W _B (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS Soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-rack (cm)	Stratum A soil dry bulk density, Pb ^A (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, AP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled poosity, e., a (cm³/cm³)  0.103  ENTER Enclosed space floor width, W a (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target	Stratum B soil dry bulk density, pp 9 (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, Ap (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{9}}}\$}^\text{\text{\text{cm}}}^3\)  0.103  ENTER Enclosed space floor width, \$\text{\text{\text{W}}}\$ (cm)  1000  ENTER  Exposure frequency,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  St.  ENTER Enclosed space floor thickness, L_crack (cm)  10  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, ps (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled poosity, 9, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for nonacriongens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, L-crack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, Ap (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER	Stratum A soil water-filled porosity, \$\text{\text{\text{\text{9}}}\$}^\text{\text{\text{cm}}}^3\)  0.103  ENTER Enclosed space floor width, \$\text{\text{\text{W}}}\$ (cm)  1000  ENTER  Exposure frequency,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  St.  ENTER Enclosed space floor thickness, L_crack (cm)  10  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, ps (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, $\Delta P$ (g/cm-s²)  ENTER  Averaging time for noncarcinogens, $\Delta T_{NC}$	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled poosity, 9, 4 (cm³/cm³)  0.103  ENTER Enclosed space floor width, W _B (cm)  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244  ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, p B (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for nonacriongens, THQ	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, Pb^ (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, \$\text{0}_{\text{a}}^{\text{A}}\$ (cm^3/cm^3) \$\text{0.103}\$ \$\text{Enclosed space floor width, \$W_{B}\$ (cm) \$\text{1000}\$ \$\text{ENTER}\$ \$\text{Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 244 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, pe (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bidg. OR eave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, ps ^c (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ $(cm^3/cm^3)$

## CHEMICAL PROPERTIES SHEET

	Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/moi)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
Į	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum 8 soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, $\theta_a^{\ C}$ (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k _v (cm ² )	Thickness of capillary zone, Loz	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³ )	Floor- wall seam perimeter, X _{crack} (cm)
. [	9.46E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
	Bidg. ventilation rate, Q _{building} (cm³/s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔH _{v,τs} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient, D ^{eff} (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deffect (cm²/s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length,  L _d (cm)
	1.69E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	1.15E-02	0.00E+00	0.00E+00	4.45E-04	2.75E-03	195
-	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
	15	1.08E+02	0.10	8.33E+01	1.15E-02	4.00E+02	5.15E+78	7.47E-04、	8.09E-02	2.0E-06	6.0E-01			

RESULTS SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA NA	NA	1.47E+06	NA	] [	6.6E-08	1.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.52E+00	3.87E+03	7.52E+00	1.47E+06	7.52E+00	. [	NA NA	NA NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

INDUSTRIAL

GW-ADV rsion 3.1; 02/04	CALCULATE R	RISK-BASED GROU	INDWATER CON	CENTRATION (	enter "X" in "YES" b	oox)						
Reset to		YES	OR									
Defaults	CALCULATE IN	ICREMENTAL RISI	KS FROM ACTUA	L GROUNDWA	TER CONCENTRA	TION (enter "X" in "YI	ES" box and initial gro	undwater conc. be	elow)			
		YES	X	J								*
	ENTER	ENTER Initial					.*					
	Chemical CAS No.	groundwater conc.,					•					
	(numbers only, no dashes)		<u>.</u>		Chemical			. · · .				
	67663	3.00E+00	]		Chloroform	1	- 1					
	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	] ENTER	ENTER	ENTER		ENTER	
MORE	Average	Depth below grade		Totals m	ust add up to value Thickness	of L _{WT} (cell G28) Thickness	1 - 1		Soil		ENIER	1
Ψ	soil/	to bottom	Depth	Thickness	of soil	of soil	Soil		stratum A SCS		User-defined	
	groundwater temperature,	of enclosed space floor,	below grade to water table.	of soil stratum A,	stratum B,	stratum C,	stratum	scs	soil type		stratum A soil vapor	
	Ts	L _F	Lwt	h _A	(Enter value or 0) h _e	(Enter value or 0) h _C	directly above water table.	soil type	(used to estimate	OR	permeability,	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	directly above water table	soil vapor permeability)		k _v	
	11	15	210	210					permeability)		(cm²)	1
	<u> </u>		210	210	0	0	Α	SL	SL			
	ENTER	ENTER	ENTER	FNTCO								
MORE	Stratum A	Stratum A	Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
<u> </u>	scs	soil dry		soil water-filled		soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C	Stratum C	Stratum C
	Soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	soil dry bulk density,	soil total porosity,	soil water-filled porosity,
	Parameters	ρ _δ ^A	n ^A	θ,,Α	Lookup Soil Parameters	$\rho_b^{B}$	n ^B	θ _w ^B	Lookup Sail	ρ _b C	n ^C	θ _w C
		(g/cm³)	(unitless)	(cm ³ /cm ³ )	Farameters	(g/cm³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	SL	1.50	0.450	0.103	S	1.66	0.375	0.054	s	1.66		
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER	1.00	0.375	0.054
<u> </u>	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		Average vapor			
	floor thickness.	pressure differential,	floor	floor	space	seam crack	air exchange		flow rate into bldg. OR			
	L _{crack}	omerential, ΔP	length, L _B	width,	height,	width,	rate.	Le	ave blank to calculate	Ð		
	(cm)	(g/cm-s²)	(cm)	W _B	H _B	W (===)	ER		Q _{soil}			
			, <u>, , , , , , , , , , , , , , , , , , </u>	(0:11)	(cm)	(cm)	(1/h)		(L/m)			
	10	40	1000	1000	300	0.1	0.83	. [	5			
MORE ↓	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER	ENTER		•				
	time for	time for	Exposure	Exposure	Target risk for	Target hazard quotient for						
	carcinogens, AT _C	noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
	(yrs)	AT _{NC} (yrs)	ED (yrs)	EF (days/yr)	TR (unitless)	THQ (unitless)						
					(Graness)	(unitiess)						
	70	25	25	250	1.0E-06	1						
				F		-						

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	3.98E+01	7.92E+03	2.3E-05	4.9E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm ² )	Stratum A soil relative air permeability, k _{rg} (cm²)	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
7.88E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ² )	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{Ts} (unitless)	Vapor viscosity at ave. soil temperature, µts (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deff cz (cm²/s)	Total overall effective diffusion coefficient, Deff, (cm²/s)	Diffusion path length, L _d (cm)
6.92E+04	1.06E+06	3.77E-04	15	7,544	1.95E-03	8.38E-02	1.76E-04	1.51E-02	0.00E+00	0.00E+00	5.93E-04	3.65E-03	195
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, ^r _{crack} (cm)	Average vapor flow rate into bldg. Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ² )	Exponent of equivalent foundation Peclet number, exp(Pe ^f ) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bidg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)	0.000-04	3.552-03	
15	2.52E+02	0.10	8.33E+01	1.51E-02	4.00E+02	6.17E+59	2.32E-04	5.83E-02	2.3E-05	4.9E-02			

**RESULTS SHEET** 

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	l NA	NA	7.92E+06	NA	]	3.3E-07	8.1E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

#### INCREMENTAL RISK CALCULATIONS:

(mg/L) (mg/L) (mg/L) (mg/L) (dilitess) (dilitess)	Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
---------------------------------------------------	---------------------------------------------------------------------	------------------------------------------------------------------------	---------------------------------------------------------------------	----------------------------------------------------------	----------------------------------------------------------------	----------------------------------------------------------------------------	------------------------------------------------------------------------------

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Chuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

W-ADV on 3.1; 02/04	CALCULATE RIS	K-BASED GROUN	NDWATER CONC	ENTRATION (er	nter "X" in "YES" bo	x)		•				
 Reset to		YES	OR	]								
Defaults	CALCULATE INC	REMENTAL RISK		. GROUNDWAT	ER CONCENTRATI	ION (enter "X" in "YE	S" box and initial grou	ndwater conc. be	elow)			
-		YES	Х	]								
	ENTER	ENTER										
	Chemical	Initial groundwater										
	CAS No. (numbers only,	conc., C _w										
	no dashes)	(μg/L)	•		Chemical		•					
	79016	5.00E-01	]		Trichloroethyle	ene						
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER st add up to value o	ENTER	ENTER	ENTER	ENTER Soil		ENTER	
MORE	Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
	groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	SCS soil type	soil type (used to estimate	OR	soil vapor permeability,	
	temperature, T _S	space floor, L _f	to water table, L _{WT}	stratum A,	(Enter value or 0) h _B	(Enter value or 0) h _C	directly above water table,	directly above	soil vapor	·	k _v	ľ
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)	•	(cm²)	
	11	15	210	210	0	0	A	SL	SL			]
	ENTED	ENTED	ENTED	ENTED	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
MORE +					Stratum B	Stratum B soil dry bulk density,		Stratum B soil water-filled porosity,	Stratum C	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
	Stratum A SCS	Stratum A soil dry bulk density, Po	Stratum A soil total porosity, n ^A	Stratum A soil water-filled porosity, $\theta_w^A$	Stratum B SCS	Stratum B soil dry bulk density, PbB	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^{\ B}$	Stratum C SCS	Stratum C soil dry bulk density, Pb C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\mathbf{C}}$
	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, P _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	Stratum A SCS Soil type Lookup Soil Parameters	Stratum A soil dry bulk density, P _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, $\theta_w^A$ (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $\rho_b^B$ (g/cm ³ )	Stratum B soil total porosity, n ⁸ (unitless)	Stratum B soil water-filled porosity, $\theta_w^{\ B}$	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, Pb C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\mathbf{C}}$
	Stratum A SCS Soil type Lookup Soil Parameters  SL ENTER	Stratum A soil dry bulk density, P _b ^A (g/cm ³ )	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER	Stratum A soil water-filled porosity, $\theta_w^A$ $(cm^3/cm^3)$	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, p _b ^B (g/cm ³ )	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space	Stratum A soil dry bulk density, Po ^A (g/cm³)  1.50  ENTER  Soil-bldg.	Stratum A soil total porosity, n^A (unitless)  0.450  ENTER Enclosed space	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters S ENTER Enclosed	Stratum B soil dry bulk density, p _b ^B (g/cm³)  1.66  ENTER Floor-wall	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor	Stratum B soil water-filled porosity, $\theta_w^B$ (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg.	Stratum C soil dry bulk density, p _b ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE	Stratum A SCS soil type Lookup Soil Perameters SL ENTER Enclosed	Stratum A soil dry bulk density, Po (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n ^A (unitless)  0.450  ENTER Enclosed	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  ENTER Average vapor flow rate into bldg. OR Leave blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack	Stratum A soil dry bulk density, Po (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Po (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length,	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height,	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  ENTER Average vapor flow rate into bldg. OR Leave blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL  ENTER Enclosed space floor thickness, Lorack	Stratum A soil dry bulk density, Po (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W	Stratum B soil total porosity, n ^B (unitless)  0.375  ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE WORE	Stratum A SCS soil type Lookup Soil perameters  SL  ENTER Enclosed space floor thickness, Loreck (cm)  10  ENTER	Stratum A soil dry bulk density, Pb (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porositive, e.g., (cm³/cm³) 0.103  ENTER Enclosed space floor width, Wa (cm)	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for	Stratum A soil dry bulk density, Po A (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for	Stratum A soil total porosity, n* (unitless)  0.450  ENTER Enclosed space floor length, Le (cm)  1000  ENTER	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE WORE	Stratum A SCS soil type Lookup Soil perameters  SL  ENTER Enclosed space floor thickness, Lorack (cm)  10  ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, P _b (g/cm³)  1.50  ENTER  Soil-bldg, pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration,	Stratum A soil water-filled porositive, the strategy of the soil water-filled porositive, the strategy of the soil water-filled porositive of the soil water floor width, water floor width, water floor width, water floor width, water floor width, water floor width, water floor width, water floor width, water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor water floor wat	Stratum B SCS SOII type Lookup Soil Parameters  S ENTER Enclosed space height, He (cm) 300 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, PB (g/cm³)  1.66  ENTER  Floor-wall seam crack width, W (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for	Stratum A soil dry bulk density, Po A (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for	Stratum A soil total porosity, n* (unitless)  0.450  ENTER Enclosed space floor length, Le (cm)  1000  ENTER	Stratum A soil water-filled porosity,	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb* (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, ΔP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, L _B (cm)  1000  ENTER  Exposure duration, ED	Stratum A soil water-filled porosity, e., (cm³/cm³).  0.103  ENTER Enclosed space floor width, Wa (cm).  1000  ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters  S ENTER Enclosed space height, H _B (cm) 300 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER  Floor-wall seam crack width, w (cm)  0.1  ENTER  Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)
MORE WORE	Stratum A SCS soil type Lookup Soil Parameters  SL ENTER Enclosed space floor thickness, Lorack (cm)  10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, Po A (g/cm³)  1.50  ENTER  Soil-bldg. pressure differential, AP (g/cm-s²)  40  ENTER  Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless)  0.450  ENTER Enclosed space floor length, Ls (cm)  1000  ENTER  Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, e, A (cm³/cm³)  0.103  ENTER Enclosed space floor width, We (cm)  1000  ENTER Exposure frequency, EF (days/yr)	Stratum B SCS soil type Lookup Soil parameters  SENTER Enclosed space height, HB (cm) 300 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, Pb (g/cm³)  1.66  ENTER Floor-wall seam crack width, w (cm)  0.1  ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, ns (unitless)  0.375  ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w ⁶ (cm ³ /cm ³ )	Stratum C SCS soil type Lookup Soil Parameters  S ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³ )	Stratum C soil total porosity, n ^C (unitless)	Stratum C soil water-filled porosity, $\theta_w^C$ (cm³/cm³)

# CHEMICAL PROPERTIES SHEET

	eiffusivity in air, D _a (cm²/s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH _{v,b} (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC
					<u> </u>	<del></del>	- · · · · · · · · · · · · · · · · · · ·	(0111 79)	(mg/L)	(µg/m )	(mg/m³)
7.	.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	3.5E-02

#### INTERMEDIATE CALCULATIONS SHEET

Exposure duration,	Source- building separation, L _T	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity, $\theta_a^C$	Stratum A effective total fluid saturation, Sha	Stratum A soil Intrinsic permeability, k	Stratum A soil relative air permeability, k _{re}	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone, n _{cz}	Air-filled porosity in capillary zone, $\theta_{acz}$	Water-filled porosity in capillary zone,	Floor- wall seam perimeter, X _{crack}
(sec)	(cm)	(cm ³ /cm ³ )	(cm³/cm³)	(cm³/cm³)	(cm³/cm³)	(cm²)	(cm²)	κ _ν (cm²)	(cm)	(cm³/cm³)	(cm ³ /cm ³ )	(cm³/cm³)	(cm)
	15::-/				<u> </u>			<u> </u>	(6111)		<u> </u>		10111)
7.88E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
	Area of		•					Stratum	Stratum	Stratum	Capillary	Total	
	enclosed	Crack-	Crack	Enthalpy of	Henry's law	Henry's law	Vapor	Α	В.	, C	zone	overall	D.W
Bidg. ventilation	space below	to-total area	depth below	vaporization at ave. groundwater	constant at ave. groundwater	constant at ave. groundwater	viscosity at ave. soil	effective diffusion	effective diffusion	effective diffusion	effective diffusion	effective diffusion	Diffusion path
rate,	grade,	ratio,	grade,	temperature,	temperature,	temperature,	temperature,	coefficient,	coefficient,	coefficient,	coefficient,	coefficient,	length,
Q _{building}	A _B	η	$Z_{crack}$	$\Delta H_{v,TS}$	H _{TS}	H' _{TS}	μτς	Deff	Deff	D ^{eff} c	D ^{eff} cz	$D^{eff}{}_{T}$	L _d
(cm³/s)	(cm²)	(unitless)	(cm)	(cal/mol)	(atm-m³/moi)	(unitless)	(g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm)
6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	1.15E-02	0.00E+00	0.00E+00	4.45E-04	2.75E-03	195
0.92E+04	1.002+00	3.772-04	1 13	0,344	5.05E-03	2.172-01	1.70E-04	1.15E-02	0.002+00	0.002+00	4.435-04	2.73E-03	195
						Exponent of	Infinite						
			Average	Crack		equivalent	source	Infinite					
Convection	Source	<b>.</b> .	vapor	effective		foundation	indoor	source	Unit				
path	vapor	Crack	flow rate	diffusion	Area of	Peclet	attenuation	bldg.	risk	Reference			
length,	conc.,	radius,	into bldg.,	coefficient,	crack,	number,	coefficient,	conc.,	factor,	conc.,			
L _p	C _{source}	F _{crack}	Q _{soli}	D ^{crack}	A _{crack}	exp(Pe ^r )	α	Chuilding	URF	RfC			
(cm)	(μg/m³)	(cm)	(cm³/s)	(cm²/s)	(cm ² )	(unitless)	(unitless)	(µg/m³)	(μg/m³) ⁻¹	(mg/m³)			
15	1.08E+02	0.10	8.33E+01	1.15E-02	4.00E+02	5.15E+78	1.83E-04	1.98E-02	1.1E-04	3.5E-02	1		
1 10	1.000702	0.10	0.335701	1.136-02	4.00=+02	J.   DE₹/0	1.03E-U4	1.905-02	1.1E-04	3.35-02	ı		

**RESULTS SHEET** 

## INCREMENTAL RISK CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)		Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	[	5.3E-07	3.9E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

**PRG SHEET** 

### INCREMENTAL RISK CALCULATIONS:

	Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)	risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
٦	9.38E-01	1.29E+03	9.38E-01	1.47E+06	9.38E-01	NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

#### DATA ENTRY SHEET

GW-ADV /ersion 3.1; 02/04	CALCULATE RI	SK-BASED GROU	JNDWATER CON	CENTRATION (	enter "X" in "YES"	box)						
Reset to		YES	OR									
Defaults	CALCULATE IN	CREMENTAL RIS	KS FROM ACTUA	L GROUNDWA	TER CONCENTRA	ATION (enter "X" in "Y	ES" box and initial gro	oundwater conc. b	elow)			
		YES	X	]					•			
	ENTER Chemical	ENTER Initial										
	CAS No.	groundwater conc., C _w					• '					
	no dashes)	(μg/L)	<u>.</u>		Chemical		•					
	79016	5.00E-01	] .		Trichloroethy	iene	]					
MORE	ENTER Average	ENTER Depth	ENTER	ENTER Totals m	ENTER ust add up to value	ENTER of L _{wt} (cell G28)	ENTER	ENTER	ENTER Soil	<del></del>	ENTER	7
<u> </u>	soil/ groundwater	below grade to bottom of enclosed	Depth below grade	Thickness of soil	Thickness of soil stratum B,	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
	temperature, T _s	space floor, L _F	to water table, L _{wt}	stratum A,	(Enter value or 0)	stratum C, (Enter value or 0) h _C	stratum directly above water table,	SCS soil type directly above	soil type (used to estimate	OR	soil vapor permeability,	
	(°C)	(cm) 15	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	soil vapor permeability)		k _v (cm²)	
. '	<u> </u>	13	210	210	00	0	Α	SL	SL		<u></u>	
MORE ¥	ENTER Stratum A SCS	ENTER Stratum A soil dry	ENTER Stratum A soil total	ENTER Stratum A soil water-filled	ENTER Stratum B SCS	ENTER Stratum B soil dry	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
	Soil type  Lookup Soil Parameters	bulk density, ρ _ь ^A (g/cm ³ )	porosity, n ^A (unitless)	porosity, θ _w ^A (cm ³ /cm ³ )	Soil type  Lookup Soil Parameters	bulk density, ρ _b ^B	soil total porosity, n ⁸	soil water-filled porosity, θ _w ^B	SCS sail type	soil dry bulk density, Pb ^C	soil total porosity, n ^C	soil water-filled porosity,
	SL	1.50	0.450	0.103	s	(g/cm³)	(unitiess)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm³/cm³)
	ENTER	ENTER	ENTER	ENTER	ENTER	1.66	0.375	0.054	8	1.66	0.375	0.054
MORE +	Enclosed space floor thickness,	Soil-bidg. pressure	Enclosed space floor	Enclosed space floor	Enclosed space	ENTER Floor-wall seam crack	ENTER Indoor air exchange		ENTER Average vapor flow rate into bldg.			
_	L _{creck} (cm)	differential, ΔP (g/cm-s²)	length, L _B (cm)	width, W _s (cm)	height, H _B (cm)	width, w	rate, ER	Le	OR ave blank to calculate Q _{ioli}	•		
	10	40	1000	1000	300	(cm) 0.1	(1/h)		(L/m)			
MORE	ENTER Averaging	ENTER Averaging	ENTER	ENTER	ENTER	ENTER	0.83	L	5			
	time for	time for oncarcinogens, AT _{NC}	Exposure duration, ED	Exposure frequency, EF	Target risk for carcinogens, TR	Target hazard quotient for noncarcinogens, THQ						
	70	(yrs) 25	(yrs) 25	(days/yr)	(unitless)	(unitless)						
END		-		230	1.0E-06  Used to calcula groundwater c	1 ate risk-based oncentration.			•		;	

# CHEMICAL PROPERTIES SHEET

Diffusivity in air, D _a (cm ² /s)	Diffusivity in water, D _w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m³/mol)	Henry's law constant reference temperature, T _R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T _B (°K)	Critical temperature, T _C (°K)	Organic carbon partition coefficient, K _{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

#### INTERMEDIATE CALCULATIONS SHEET

	Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm³/cm³)	Stratum B soil air-filled porosity, $\theta_a^B$ (cm³/cm³)	Stratum C soil air-filled porosity, e _a c (cm³/cm³)	Stratum A effective total fluid saturation, Ste (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rg} (cm ² )	Stratum A soil effective vapor permeability, k, (cm²)	Thickness of capillary zone,  L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm³/cm³)	Air-filled porosity in capillary zone, θ _{a,cz} (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
	7.88E+08	195	0.347	0.321	0.321	0.156	5.94E-09	0.917	5.45E-09	25.00	0.45	0.130	0.320	4,000
							, , , , , , , , , , , , , , , , , , , ,			20.00	0.40	0.150	0.320	4,000
_	Bidg. ventilation rate, Q _{building} (cm ³ /s)	Area of enciosed space below grade, A _B (cm ² )	Crack- to-total area ratío, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature,  µts (g/cm-s)	Stratum A effective diffusion coefficient, Deff A (cm²/s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} _{c2} (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
Г	6.92E+04	1.06E+06	3.77E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	4 4 5 5 00 1					
	Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient.	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	0.00E+00  Unit risk factor,	0.00E+00  Reference conc.,	4.45E-04	2.75E-03	195
	L _p (cm)	C _{source} (μg/m³)	r _{crack} (cm)	Q _{soil} (cm³/s)	D ^{crack} (cm²/s)	A _{crack} (cm²)	exp(Pe ^f ) (unitless)	α (unitless)	C _{building} (μg/m³)	URF (μg/m ³ ) ⁻¹	RfC (mg/m³)			
	15	1.08E+02	0.10	8.33E+01	1.15E-02	4.00E+02	5.15E+78	1.83E-04、	1.98E-02	2.0E-06	6.0E-01			

## RESULTS SHEET

## RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

## **INCREMENTAL RISK CALCULATIONS:**

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (µg/L)		risk from vapor intrusion to indoor air, carcinogen (unitless)	quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA	NA	1.47E+06	NA	]	9.7E-09	2.3E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

PRG SHEET

### INCREMENTAL RISK CALCULATIONS:

Indoor	Indoor	Risk-based	Pure	Final		Incremental risk from	Hazard quotient
exposure	exposure	indoor	component	indoor		vapor	from vapor
groundwater	groundwater	exposure	water	exposure		intrusion to	intrusion to
conc., carcinogen	conc., noncarcinogen	groundwater conc.,	solubility, S	groundwater		indoor air,	indoor air,
(mg/L)	(mg/L)	(mg/L)	(mg/L)	conc., (mg/L)		carcinogen (unitless)	noncarcinogen (unitless)
					:		
5.16E+01	2.21E+04	5.16E+01	1.47E+06	5.16E+01		NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"